

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-V • EXAMINATION – SUMMER 2013****Subject Code: 151002****Date: 21-05-2013****Subject Name: Engineering Electromagnetic****Time: 10.30 am - 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) Explain Cross Product & Dot Product in detail. **04**  
 (b) Explain Position and distance vectors with suitable example. **04**  
 (c) Define followings: 1. Electric Flux Density 2. Potential 3. Field **06**
- Q.2** (a) Given vectors  $A = 3a_x + 4a_y + a_z$  and  $B = 2a_y - 5a_z$ , find the angle between A and B. **04**  
 (b) Given point P ( $\hat{r}$  2, 6, 3) and vector  $A = ya_x + (x + z)a_y$ , express P and A in cylindrical and spherical coordinates. Evaluate A at P in the Cartesian, cylindrical, and spherical systems. **07**

**OR**

- (b) Explain spherical coordinate system. **07**  
 (c) Explain Coulomb's Law and Field Intensity with suitable example. **03**
- Q.3** (a) Given the potential  $V = 10/r^2 \sin \cos$  **06**  
 (1) Find the electric flux density D at (2,  $\sqrt{2}$ , 0).  
 (2) Calculate the work done in moving a 10  $\mu$ C charge from point A (1, 30°, 120°) to B (4, 90°, 60°).  
 (b) Write short notes on potential gradient. Find the gradient of the following scalar field  $= e^{-z} \sin 2x \cosh y$ . **05**  
 (c) Explain the Electric Dipole. **03**

**OR**

- Q.3** (a) Write a short note on Divergence Theorem with suitable example **04**  
 (b)  $\nabla \cdot \mathbf{J} = -\frac{\partial \rho_v}{\partial t}$  ; Continuity of current equation. **06**  
 Prove that  
 (c) Write down a Point and integral forms of Maxwell's equations for steady electric and magnetic fields. **04**
- Q.4** (a) Determine magnetic Field intensity H for Infinitely Long Coaxial Transmission Line. **07**  
 (b) Write down a statement of Biot-Savart's law and explain in detail **07**

**OR**

- Q.4** (a) write short notes on magnetic boundary conditions **06**  
 (b) A parallel-plate capacitor with plate area of 5 cm<sup>2</sup> and plate separation of 3 mm has a voltage 50 sin 10<sup>3</sup>tV applied to its plates. Calculate the displacement current assuming  $\epsilon = 2 \epsilon_0$ . **04**  
 (c) What do you mean by skin depth? Explain in brief. **04**
- Q.5** (a) The electric field in free space is given by  $E = 50 \cos (10^8 t + \beta x) a_y$  V/m **07**  
 (1) Find the direction of wave propagation.  
 (2) Calculate  $\beta$  and the time it takes to travel a distance of  $\sqrt{2}$ .  
 (b) Write down a general procedure for solving poisson's or laplace's equation & also explain a Uniqueness theorem. **07**

**OR**

- Q.5** (a) Explain plane waves in free space. **07**  
 (b) In free space ( $z \geq 0$ ), a plane wave with  $H = 10 \cos (10^8 t - z) a_x$  mA/m is incident normally on a lossless medium ( $\epsilon = 2 \epsilon_0$ ,  $\mu = 8 \mu_0$ ) in region  $z < 0$ . Determine the reflected wave  $H_r$   $E_r$  and the transmitted wave  $H_t$ ,  $E_t$ . **07**