

Total No. of Questions : 8]

SEAT No. :

**P3598**

**[5560]-553**

[Total No. of Pages : 2

**T.E. (Electronics & Telecommunications)**

**ELECTROMAGNETICS**

**(2015 Pattern) (Semester - I) (304183)**

*Time : 2.30 Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2; Q3 or Q4; Q5 or Q6; Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of smith chart and calculator is allowed.
- 5) Assume suitable data if necessary.

- Q1)** a) A point charge of 30 nC is located at the origin, while plane  $y = 3$  carries charge  $10\text{nC/m}^2$ . Find  $\vec{D}$  at (0, 4, 3). [7]
- b) Derive an expression for capacitance of parallel plate capacitor. [6]
- c) Define Biot-Savart's law. Derive the expression for magnetic field intensity due to straight infinite current filament. [7]

OR

- Q2)** a) Derive the expression of electric field intensity due to infinite sheet of charge with density  $\rho_s \text{ C/m}^2$ . [7]
- b) A 15nC point charge is at the origin in free space. Calculate  $V_1$  at point  $P_1 (-2, 3, -1)$  if : (a)  $V = 0$  at (6, 5, 4); (b)  $V = 0$  at infinity. [6]
- c) Derive the boundary condition that exist between the two different magnetics materials. [7]

- Q3)** a) What do you mean by displacement current. Prove that displacement current density is given by  $\vec{J}_d = \frac{\partial \vec{D}}{\partial t}$ . [8]
- b) State Faradays Law. A circular loop lies in  $z = 0$  plane has radius of 0.2m & resistance of 10 ohm. Find the current flowing through the conductor due to field  $\vec{B} = 0.2 \sin 10^3 t \hat{a}_z$ . [8]

OR

- Q4)** a) State and explain Maxwell's equation for time varying field in integral and point form. [8]
- b) State and prove Poynting Theorem. State significance of Poynting vector. [8]

**P.T.O.**

- Q5) a)** Derive the expression for characteristics impedance and propagation constant in term of primary constant of transmission line. [8]
- b)** A distortionless line has  $z_0 = 60 \Omega$ ,  $\alpha = 20 \text{ mNp/m}$ , velocity of propagation  $= 0.6c$ , where  $C$  is the speed of light in a vacuum. Find  $R$ ,  $L$ ,  $G$ ,  $C$  and  $\lambda$  at 100 MHz. [10]

OR

- Q6) a)** Discuss the reflection of wave on shorted, open circuited and matched transmission line. [8]
- b)** A lossless transmission line with  $z_0 = 75 \Omega$  is 30m long and operates at 2MHz. The line is terminated with a load  $Z_L = 90 + j60 \Omega$ . If  $u = 0.6c$  on the line, using Smith chart find [10]
- Reflection coefficient
  - Standing wave ratio
  - Input impedance
  - Load admittance

- Q7) a)** What do you mean by uniform plane wave. Using Maxwell's equations in phasor notation, derive the expression for Helmholtz's equation in free space. [8]

- b)** A plane wave in a nonmagnetic medium has  $\vec{E} = 50 \sin(10^8 + 2z) \hat{a}_y \text{ V/m}$ . Find [8]
- Direction of wave propagation
  - Wavelength, frequency
  - Magnetic field  $H$

OR

- Q8) a)** For uniform plane wave, explain the terms: [8]
- Depth of penetration.
  - Polarization.
- b)** Given the intrinsic impedances :  $\eta_1 = 100 \Omega$  and  $\eta_2 = 300 \Omega$ , the normal incident electric field  $E_i = 100 \text{ mV/m}$ , calculate : [8]
- Reflection and transmission coefficient.
  - Reflected and transmitted electric field  $\vec{E}$
  - Reflected and transmitted magnetic field  $\vec{H}$

\*\*\*