

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 10nC/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]

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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 λ 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 \vec{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}
