

B.Tech II Year II Semester (R15) Regular Examinations May/June 2017  
**ELECTROMAGNETIC THEORY & TRANSMISSION LINES**  
 (Electronics & Communication Engineering)

Time: 3 hours

Max. Marks: 70

**PART - A**  
 (Compulsory Question)

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- 1 Answer the following: (10 X 02 = 20 Marks)
- Define electric field and electric flux density.
  - Define electric dipole. Differentiate between polar and nonpolar dielectrics.
  - State and express the Stokes theorem.
  - Write down the Maxwell's equations in free space condition.
  - Define skin depth or depth of penetration.
  - State and express the Poynting theorem.
  - Write down the distortion less line.
  - Define transmission line. Explain different types of transmission lines.
  - Define the voltage standing wave ratio.
  - Difference between the single stub matching and double stub matching.

**PART - B**  
 (Answer all five units, 5 X 10 = 50 Marks)

**UNIT - I**

- 2 Uniform line charge of  $0.4 \mu C$  and  $-0.4 \mu C$  are located in the  $x = 0$  plane at  $y = -0.6$  and  $0.6$  m respectively. Let  $\epsilon = \epsilon_0$ . Find E at:
- $P(x, 0, z)$
  - $Q(2, 3, 4)$

OR

- 3 Given  $D = 8\rho \sin \phi \hat{a}_\rho + 4\rho \cos \phi \hat{a}_\phi$  C/m<sup>2</sup>.  
 Find the volume charge density at  $P(2.6, 38^\circ, -6.1)$ .  
 How much charge is located inside the region defined by  $0 < \rho < 1.8, 0^\circ < \phi < 70^\circ, 2.4 < z < 3.1$ .

**UNIT - II**

- 4 A unit vector directed from region 1 to region 2 at the planar boundary between two perfect dielectrics is given as  $\hat{a}_{N12} = (-2/7)\hat{a}_x + (3/7)\hat{a}_y + (6/7)\hat{a}_z$ . Assume  $\epsilon_{r1} = 3, \epsilon_{r2} = 2$  and electric field in region 1 is  $\vec{E}_1 = 100\hat{a}_x + 80\hat{a}_y + 60\hat{a}_z$  V/m. Find the electric field  $\vec{E}_2$ , polarization vector  $\vec{P}_2$  in region 2 and the angles made by the vectors  $\vec{E}_1$  and  $\vec{E}_2$  with the normal to the interface.

OR

- 5 Derive an equation for magnetic field intensity due to:
- Infinite line placed along z-axis at an observation point P on y axis.
  - Infinite sheet with uniform current density placed in  $z = 0$  plane.

Contd. in page 2

**UNIT - III**

- 6 In a lossless medium  $\eta = 40\pi$ ,  $\mu_r = 1$  and  $H = 2 \cos(\omega t - z)\hat{a}_x + 5 \sin(\omega t - z)\hat{a}_y$  A/m. Find  $\epsilon_r$ ,  $\omega$  and E for the medium.

**OR**

- 7 In a medium  $\vec{E} = 16e^{-0.05x} \sin(2 \times 10^8 t - 2x)a_z$  V/m find:
- Propagation constant.
  - Wavelength.
  - Speed of the wave.

**UNIT - IV**

- 8 In a nonmagnetic material  $H = 30 \cos(2\pi \times 10^8 t - 6x)\hat{a}_y$  mA/m. Calculate:
- The intrinsic impedance.
  - The Poynting vector.
  - The time average power crossing the surface.  
 $x = 1, 0 < y < 2, 0 < z < 3$  m.

**OR**

- 9 Explain reflection of uniform plane wave by a perfect conductor in the case of oblique incidence for parallel polarization.

**UNIT - V**

- 10 A transmission line 100 km long has the following impedance measurements at 1796 Hz,  $Z_{oc} = 328 \angle -29.2^\circ$ ,  $Z_{sc} = 1548 \angle 6.8^\circ$ . Determine the primary line constants.
- OR**
- 11 Using Smith chart, determine VSWR, the input impedance and reflection coefficient at the input end of a transmission line of  $50 \Omega$ , terminated by a load impedance of  $Z_L = 25 + j50 \Omega$ . The length of the line is 60 cm and the wavelength on the line  $\lambda = 2$  cm.

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