Code No: 124CU **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, December - 2017
ELECTROMAGNETIC THEORY AND TRANSMISSION LINES
(Common to ECE, ETM)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Find Electric field intensity due to the charge distribution ρ_v. [2]
b) Write poisson's and Laplace equations. [3]
c) State Biot-Savart's law. [2]
d) Calculate the self inductance per unit length of an infinitely long solenoid. [3]
e) Write a wave equation in a lossy, charge free medium based on Maxwell's Equation. [2]
f) What is Brewster angle? Write its equation. [3]
g) What is condition for distortion less transmission line? [2]
h) Explain how Quarter wave transformer is used for matching? [3]
i) What is the value of characteristic impedance and reflection coefficient for an open circuited line? [2]
j) What are the characteristics of smith chart? [3]

PART-B

(50 Marks)

2.a) Point charges 5nC and -2nC are located at (2,0,4) and (=3,0,5), respectively. Find the electric field at (1,-3,7).
b) Given that $E=(3x^2+y_0)a_x+xa_y)$ kV/m, find the work done in moving a –2μC charge from (0,5,0) to (2,-1,0) by taking the path. [5+5]

OR

3.a) An electric dipole of $100a_z$pC.m is located at the origin. Find V and E at point $(1,\pi/3,\pi/2)$.
b) Three point charges -1nC, 4nC, and 3nC are located at (0,0,0),(0,0,1) and (1,0,0) respectively. Find the energy in the system. [5+5]

4.a) A circular loop located on $x^2+y^2=9$, z=0 carries a direct current of 10A along a_ϕ. Determine H at (0,0,4) and (0,0,-4).
b) In a certain conducting region, $H=yz(x^2+y^2)a_x-y^2xza_y+4x^2y^2a_z$mA/m. Determine J at (5,2,-3). [5+5]

OR

5.a) State Maxwell's equations in an integral and word form.
b) A unit normal vector from region 2 ($\mu=2\mu_0$) to region 1 ($\mu=\mu_0$) is $a_{n21}=(6a_x+2a_y-3az)/7$. If $H_1=10a_x+a_y+12a_z$ A/m and $H_2=H_{2x}a_x-5a_y+4a_z$ A/m. Determine H_{2x}. [5+5]

6.a) A lossy material has $\mu=5\mu 0$, $\varepsilon=\varepsilon_0$. If at 5 MHz, the phase constant is 10 rad/m, calculate the loss tangent, conductivity of the material, complex permittivity attenuation constant and intrinsic impedance.

b) Derive the equation for intrinsic impedance in lossless dielectrics. [5+5]

OR

7.a) Determine the Fresnel coefficients for oblique incidence from lossless medium 1 to lossless medium 2 for parallel polarization.

b) Region 1 is a lossless medium for which $y \geq 0$, $\mu=\mu_0$, $\varepsilon=4\varepsilon_0$, whereas region 2 is free space, $y \leq 0$. If a plane wave $E=5\cos(108t+\beta t)a_z$ V/m exists in region1, find the time average pointing vector. [5+5]

8.a) A transmission line operating at 500MHz has $Z_0=80\Omega$, Propagation constant = 0.04 Np/m, $\beta=1.5$ rad/m. Find the line parameters R, L, G and C?

b) Find the Z_{in} at any point on the line in terms load impedance starting from voltage and current wave equations on line. [5+5]

OR

9.a) For a lossless two wire transmission line show that the Characteristic impedance $Z_0 = \frac{120}{\sqrt{\epsilon_r}}\, cosh^{-1}\, \frac{d}{2a}$.

b) A lossless transmission line operating at 4.5GHz has L=2.4μH/m and $Z_0=85\Omega$. Calculate the phase constant and the phase velocity. [5+5]

10.a) A 500Ω lossless line has $V_L = 10e^{j25^0}$V and $Z_L = 50e^{j30^0}\Omega$. Find the current at λ/4 from the load?

b) A 60 Ω air line operating at 20MHz is 10m long. If the input impedance is 90 +j150Ω. Calculate Z_L, Γ and S. [5+5]

OR

11. Explain how double stub is used for matching with suitable diagram? Derive equations for its length and location. [10]

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