**Code No: 114CU** **R13**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B.Tech II Year II Semester Examinations, May - 2016**
**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) How can materials be classified in terms of their conductivity? [2]
b) Give an expression for convection current density. Also state the point form of Ohm's Law. [3]
c) State Maxwell's equations for a lossless or non conducting medium. [2]
d) State the Amphere's Force Law. Give magnetic force for arbitary geometrics. [3]
e) Give an expression for intrinsic impedance in phasor form. What are its magnitude and phase components? [2]
f) Explain in brief significance of loss tangent. [3]
g) List any four types of transmission lines. [2]
h) How does group velocity vary when compared to phase velocity? [3]
i) What are the two families of circles that constitute the Smith Chart? [2]
j) What are the advantages and disadvantages of a Single Stub? [3]

**PART - B** **(50 Marks)**

2.a) State Coulomb's Law. Find the force on charge $Q_1$, 30 μc due to a change $Q_2$, -200 μc, where $Q_1$ is at (0,0,2) m and $Q_2$ is at (2,1,0) m.
b) Derive the relation between electric field, E and Scalar potential, V. Find the electric field at (2,3,1) if the potential distribution is of the form $3x^2y+y^2x+3z$. [5+5]

**OR**

3.a) Discuss the Maxwell's equations for electrostatic fields.
b) Obtain the expression of Gauss's Law for infinite surface charge. Also state any two limitations of Gauss's Law. [5+5]

4.a) State the important properties of magnetic lines of forces.
b) Show that the magnetic field due to a finite current element along z-axis at a point P "r" distance away from y-axis is given by $\overrightarrow{H} = \frac{1}{4\pi r}\left(\text{Sin}\,\alpha_1 - \text{Sin}\,\alpha_2\right) a\phi$, where "I" is the current through the conductor, $\alpha_1, \alpha_2$ are the angles made by the tips of the conductor element at P. [5+5]

**OR**

5.a) What are boundary conditions? State the boundary conditions at the interface of dielectric and perfect conductor.

b) A certain material has $\sigma = 0$ and $\epsilon_r = 1$, if $\vec{H} = 4\sin(10^6 t - 0.01z)\vec{a_y} A/m$. Use Maxwell's equations to find $\mu_r$. [5+5]

6.a) Derive the relation between E and H in a Uniform plane wave.

b) What are the wave equations for a lossless medium and a conducting medium for sinusoidal variations? [5+5]

**OR**

7.a) Write short notes on normal incidence of a plane wave on a perfect dielectric.

b) A plane wave travelling in air is normally incident on a material with $\epsilon_r = 4$ and $\mu_r = 1$. Find the reflection and transmission coefficients. [5+5]

8.a) Derive the expression for voltage and current at any point on the transmission line in terms of characteristics impedance.

b) Discuss the parameters that characterize a lossless and lowloss transmission line. [5+5]

**OR**

9.a) What is distortion? State the conditions that characterize a distortion less line.

b) The propagation constant of a lossy transmission line is $(1+j2)m^{-1}$ and its characteristic impedance is 20 Ω at w = 1M rad/s. Find L ,C, R and G for the line. [5+5]

10.a) What are the applications of transmission lines?

b) How can ultra high frequency transmission lines be used as circuit Elements? [5+5]

**OR**

11.a) What are the applications of Smit Chart.

b) One end of a lossless transmission line having the characteristic impedance of 75 Ω and length of 1 cm is short circuited. At 3 GHz, What is the input impedance at the other end of the transmission line? [5+5]

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