

Code No: 114CU

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 Ampere's Force Law. Give magnetic force for arbitrary geometries. [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 , $30\ \mu\text{C}$ due to a charge Q_2 , $-200\ \mu\text{C}$, where Q_1 is at $(0,0,2)$ m and Q_2 is at $(2,1,0)$ m. [5]
- 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]

OR

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

- 4.a) State the important properties of magnetic lines of forces. [5]
- 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 $\vec{H} = \frac{1}{4\pi r} (\sin \alpha_1 - \sin \alpha_2) a_\phi$, where "I" is the current through the conductor, α_1, α_2 are the angles made by the tips of the conductor element at P. [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 $\vec{H} = 4 \sin(10^6 t - 0.01 z) \vec{a}_y \text{ A/m}$. Use Maxwell's equations to find μ_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 low loss 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 $(1+j2)\text{m}^{-1}$ and its characteristic impedance is 20Ω at $\omega = 1\text{M rad/s}$. 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 75Ω 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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