

R13

Code No: 114CU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, February -2024

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

(Electronics and Communication Engineering)

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

- 1.a) Define the various types of distortions in transmission lines. [2]
- b) Derive relation between VSWR and reflection coefficient. [3]
- c) Define reflection loss and insertion loss. [2]
- d) Define skin effect. [3]
- e) Define lossless and conducting mediums. [2]
- f) State Biot - Savart's law. [3]
- g) Give the equation of force on between two current elements. [2]
- h) Obtain the expression for parallel plate capacitor. [3]
- i) State Maxwell's equations in integral form. [3]
- j) What is loading of transmission lines? [2]

PART-B

(50 Marks)

- 2.a) Evaluate the electric field intensity at a point P (-5, 7,-4) in free space due to a charge of 0.2 milli coulombs placed at point R(2,-1,-2).
- b) Derive the expression for point form of Gauss law. [5+5]

OR

- 3.a) Define Electric field intensity at a point. Derive the expression for E for a line charge.
- b) An infinitely long uniform line charge is located at $y = 3, z = 5$ of $P_L = 30 \text{ nc/m}$ Find E at the origin. [5+5]

- 4.a) State and explain Faraday's law of induction & magnetic flux.
- b) A current element 4 cm long is along y-axis with a current of 10 mA flowing in y-direction. Determine the force on the current element due to the magnetic field if the magnetic field $H = 5/\mu \text{ ax A/m}$. [5+5]

OR

- 5.a) Starting with Ampere's law, derive Maxwell's equation in integral form based on this law and obtain the corresponding differential equation by applying Stroke's theorem.
- b) Given $E = 10\sin(\omega t - \beta z)$ ay V/m in the free space, determine D,B,H. [5+5]

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- 6.a) Derive the relationship between E and H field and show that $E/H=120 \pi$.
b) Write briefly about instantaneous, average and complex Poynting vectors. [5+5]

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- 7.a) Differentiate the wave propagation in good conductors and good dielectrics.
b) Write a short note on power loss in a plane conductor. [5+5]

- 8.a) Derive an expression for input impedance at any point in a transmission line.
b) Derive the secondary constants for a low loss transmission line. [5+5]

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- 9.a) Derive the condition for distortion less transmission line.
b) Define phase and group velocities and derive relation between them. [5+5]

- 10.a) Explain the design procedure of single stub matching.
b) A 50 ohm line is terminated with a load $Z_L = 75 + j 65$ ohms. Determine the input impedance of quarter wave transformer to this transmission line and load. [5+5]

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- 11.a) Explain the characteristics and applications of Smith chart.
b) Sketch input impedance versus line length for short and open circuited lines with $0 < l < \lambda$. [5+5]

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