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10TE54

Fifth Semester B.E. Degree Examination, June/July 2018
Transmission Lines and Waveguides

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting atleast TWO questions from each part.*
2. Use of Smith chart is permitted.

PART – A

1 a. Derive expressions for voltage and current at any point on an uniform transmission line and hence deduce an expression for input impedance. **(12 Marks)**

b. A lossless transmission line with characteristic impedance 500 ohms is excited by a signal of voltage $10\angle 0°$ volts at 1.2 MHz. If the line is terminated by Z_L at a distance of 1 km, calculate (i) input impedance of the line for $Z_L = \infty$ and 0 (ii) the voltage at the midpoint of the line for $Z_L = Z_O$. **(08 Marks)**

2 a. Obtain the expression for input impedance in open and short circuited line. Plot the graph Z_{sc}/R_o v/s distance and Z_{OC}/R_O v/s distance. **(10 Marks)**

b. Derive the expression for cut-off frequency and characteristic impedance of constant-K low-pass filter – T section. **(10 Marks)**

3 a. What are the applications and properties of Smith Chart? Explain in detail with neat diagram. **(09 Marks)**

b. A transmission line 50 cm long has a characteristic impedance of 50 Ω, VSWR = 2, voltage minima occur at 20 cm and 40 cm from the load end. Using Smith chart find (i) Input impedance (ii) Load impedance. **(11 Marks)**

4 a. Explain in detail the Quarter-wave line; impedance matching and any four of its applications. **(12 Marks)**

b. A load impedance of $Z_R = (60 - j80)\Omega$ is required to be matched to a 50 Ω coaxial line, by using a single short circuited stub of length 'L' located at a distance 'd' from the load. The wave length of the operation is 1 (one) meter. Find 'd' and 'L'. **(08 Marks)**

PART – B

5 a. Write the properties of S-parameters and derive them. **(10 Marks)**

b. Two transmission lines of characteristic impedance Z_1 and Z_2 are joined at plane PP'. Express S-parameters in terms of impedances. **(06 Marks)**

c. Write relationship of ABCD parameters with S-parameters. **(04 Marks)**

6 a. Derive the relevant equations for the propagation of TE waves in a rectangular wave guide and explain how the dominant mode is obtained. **(12 Marks)**

b. An air-filled circular waveguide having an inner radius of 1 cm is excited in dominant mode at 10 GHz. Find
(i) The cut-off frequency of dominant mode
(ii) Guide wave length
(iii) Wave impedance
(iv) Find the band width for operation in dominant mode only. **(08 Marks)**

7 a. With the schematic diagram, explain the directional coupler. Derive an expression and give scattering matrix representation of the directional coupler. **(10 Marks)**

b. "Waveguide acts as a high-pass filter". Derive the expression. **(05 Marks)**

c. Obtain the [S] matrix of an isolator. An isolator perfectly matched has an insertion loss of 0.2 dB in the forward direction and an isolation of 30 dB in the reverse direction. Determine the scattering parameters. **(05 Marks)**

8 a. Describe the comparison between GUNN, IMPATT, TRAPATT and BARITT diodes. **(08 Marks)**

b. Explain the working of Schottky Diode? **(06 Marks)**

c. Explain in brief Manley-Rowe relations. **(06 Marks)**

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