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10TE54

Fifth Semester B.E. Degree Examination, June/July 2019
Transmission Lines and Waveguides

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Formulate the differential equations of uniform general transmission lines from fundamentals and find their general solution in terms of voltage (E) and current (I) in exponential form at any point on the line. **(12 Marks)**

b. A 10 km length of transmission line is having a characteristic impedance of $240 - j140\ \Omega$ and a propagaton constant of $0.06 + j0.05\ \Omega$. The line is operated at a frequency of 800 Hz. Calculate the resistance and inductance/capacitance of the equivalent T-network. **(08 Marks)**

2 a. A 50 MHz open wire line is to be built of copper wire of diameter 3.264 mm and to have $R_0 = 425\ \Omega$, find the desired spacing 'd', then calculate the total L and C of 5 meters of this line if line is dissipationless. **(06 Marks)**

b. Derive the relationship between standing wave ratio and reflection co-efficient. **(06 Marks)**

c. Explain parameters of co-axial cable at radio frequencies. **(08 Marks)**

3 a. Obtain the expressions for input impedance of open and short circuited lines and also show variation of input impedance of dissipationless line as a function of length. **(10 Marks)**

b. Define impedance of quarterwaveline. List the applications of quarterwave line. **(05 Marks)**

c. A load impedance of $250 - j125\ \Omega$ is to be matched to a dissipationless line of characteristic impedance of $500\ \Omega$. The wavelength of wave travelling through line is 3.75 m. Determine shortest distance from the load to the location of a short circuited stub and proper length of short circuited stub. **(05 Marks)**

4 a. A line of characteristic resistance equal to $300\ \Omega$ is connected to a load of $73\ \Omega$ resistnace. For a frequency of 45 MHz, the line is to be matched using double stubs with one stub located as near the load as possible. Find lengths of both the stubs, termination and location of the second stub using quarter-wave spacing between the two stubs. **(10 Marks)**

b. Derive the expressions of impedances for a short circuit and open circuit quarter wave line of small dissipation. **(10 Marks)**

PART – B

5 a. State and prove properties of S-parameters. **(10 Marks)**

b. Give the comparison among [S], [Z] and [Y] matrices. **(05 Marks)**

c. Two transmission lines of characteristic impedance Z_1 and Z_2 are joined at plane PP'. Express S-parameters in terms of impedances. **(05 Marks)**

6 a. An air filled rectangular waveguide of inside dimensions 7×3.5 cm operates in dominant TE_{10} mode. Find : (i) Cut off frequency (ii) Determine phase velocity of wave in guide at frequency of 3.5 GHz. (iii) Determine guided wavelength at same frequency. **(04 Marks)**

b. Explain TE wave solution of circular waveguide. **(10 Marks)**

c. Explain different modes of excitation in a rectangular waveguide. **(06 Marks)**

7 a. Explain modes of operation of GUNN diode and its criteria for classification of modes. **(10 Marks)**

b. Explain the structure and working of READ diode. **(10 Marks)**

8 a. What are Manbey-Rawe relations? How are they useful in understanding parametric amplifier? **(10 Marks)**

b. Explain operation of PIN diode and its application. **(10 Marks)**

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