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10TE54

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Transmission Lines and Waveguides

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Deduce the expression for attenuation constant and phase constant for the following conditions:
i) If a transmission line is to have neither frequency distortion nor delay distortion.
ii) The ordinary telephone cable. **(06 Marks)**

b. A transmission line has a characteristic impedance of $710 \angle -16^\circ$ at 1 kHz. At this frequency, attenuation and phase shift is found to be 0.01 Np and 0.035 radians per km respectively. Calculate the primary constants of the line. **(08 Marks)**

c. With necessary equations, draw the equivalent T-section for transmission line. **(06 Marks)**

2 a. Define insertion loss. Derive an expression for insertion loss of a transmission line. **(10 Marks)**

b. A prototype low pass constant K π-section filter network consists of a series arm inductance of 20 mH and two shunt arm capacitor of 0.16 μF each. Calculate the cut-off frequency, attenuation and phase shift at 15 kHz. What is the value of the nominal impedance in the pass band?

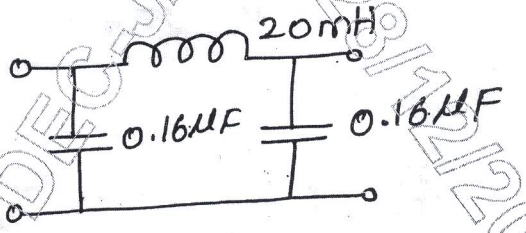

Fig.Q2(b) **(05 Marks)**

c. Show that the maximum and minimum impedance on the line for a lossless line is given by RoS and R_o/S respectively. **(05 Marks)**

3 a. Derive expressions for input impedances of open and short circuited lines at radio frequencies. Sketch and comment on the variations of normalized reactance's with various lengths of the line. **(10 Marks)**

b. Explain the applications of quarter wave line. **(06 Marks)**

c. Calculate the standing wave ratio and reflection coefficient on a line having $Z_0 = 300\ \Omega$ and terminated by $Z_R = 300 + j400\Omega$. **(04 Marks)**

4 a. Consider quarter wave small dissipation line. Derive expressions for short circuited and open circuited input impedances. **(08 Marks)**

b. A load impedance of $Z_R = 200 - j100\Omega$ is required to be matched to a 400Ω line by using a short circuited stub of length 'ℓ' located at a distance 'd' from the load. The wavelength of operation is 3 meter. Solve the problem numerically and then by Smith chart. **(12 Marks)**

PART – B

5 a. Explain the theory of scattering matrix for a multiport network. **(06 Marks)**

b. State and prove the properties of S-parameters. **(10 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. **(04 Marks)**

6 a. Derive expressions for guide wavelength, phase and group velocities for TM_{mn} waves in rectangular waveguides. **(06 Marks)**

b. Draw a neat diagram of a H-plane Tee junction and explain its operation. Write its [s] matrix. **(07 Marks)**

c. Dominant mode is propagated through a waveguide of breadth 10 cm at frequency of 2.5 GHz. Find:

i) Cut-off wavelength ii) Phase velocity iii) Group velocity

iv) Guide wavelength v) Wave impedance vi) Phase constant **(07 Marks)**

7 a. With a neat diagram, explain the working of 2-hole directional coupler. **(06 Marks)**

b. Explain the operation of parametric amplifier with equivalent circuit. Also explain Manley-Rowe relations. **(07 Marks)**

c. With a neat diagram, explain the operation of a Faraday rotation isolator. **(07 Marks)**

8 a. Explain the working principle of GUNN diode. **(06 Marks)**

b. Explain the construction and working of varactor diode. **(06 Marks)**

c. Explain operating principle and mechanism of oscillations in IMPATT diode with neat and relevant diagram. **(08 Marks)**

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