PVP 12

Code: EC5T2

III B.Tech - I Semester – Regular Examinations - November 2014

TRANSMISSION LINES AND WAVE GUIDES
(ELECTRONICS & COMMUNICATION ENGINEERING)

Duration: 3 hours Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1. a) Derive the conditions for distortion less transmission line. 7 M

b) A transmission line designed for power transmission at 60 Hz is made with superconducting cables. The two conductors that make the transmission line are separated by 3 m. The size of the wires is not known, but their inductance per unit length is known to be 0.5 μH/m. The permittivity and permeability are those of free space and the conductivity of air is 10^{-7} S/m. Calculate:

(i) The attenuation constant on the line. 4 M

(ii) The characteristic impedance of the line 3 M

2. a) Obtain the power relations on a general transmission line. 7 M

b) A transmission line has propagation constant $\gamma = 0.01 + j0.05$, characteristic impedance $Z_o = 50\ \Omega$ and a load $Z_L = 50 + j50\ \Omega$ is connected at one end. Calculate:

(i) The impedance on the line at the load. 2 M

(ii) The impedance at a distance of 10 m from the load. 5 M

3. a) Explain the construction of smith chart. 7 M

b) i) Define the conditions for matching on a transmission line. 3 M

ii) How is stub matching accomplished? What is the basic principle involved? 4 M

4. a) Describe the propagation of narrow pulses on finite, lossless transmission lines using relevant expressions and diagrams. 10 M

b) What constitutes an initial condition on the line? 4 M

5. a) Derive the expressions for field components of TM waves between parallel planes. 8 M

b) Write the expressions for propagation constant, phase constant, phase velocity, group velocity and wave impedance for TE case. 6 M

6. a) Derive the expression for TE mode field components of rectangular wave guide. 7 M

b) A standard rectangular waveguide, designated as EIA WR75 has internal dimensions a = 19.05 mm and, b = 9.53 mm. The waveguide is air filled and propagates waves at 18 GHz.

(i) Calculate the cutoff frequency for the dominant mode for TM case. 2 M

(ii) For the mode in (i), calculate the guide wavelength, guide phase constant, guide phase velocity, and the wave impedance for TM propagation at 18GHz. 5 M

7. a) Derive the expression for fields and wave impedance for TE mode in circular wave guides. 8 M

b) An air-filled circular wave guide is to be operated at a frequency of 6GHz and is to have dimensions such that f_c=0.8f for the dominant mode. Determine the diameter of the guide, phase velocity of the guide. 6 M

8. Write notes on

a) Q factor of a cavity resonator. 7 M

b) Losses in microstrip line. 7 M