B.E.Degree Examinations, Nov 2011

Electronics and Communication Engineering

EC 9305 – Transmission lines and Waveguides

V Semester Full Time

22

Time : 3 Hours **Answer All Questions** **Max.marks: 100**

SMITH CHART MUST BE PROVIDED

PART-A **(10x 2 = 20 marks)**

1. Specify the merits and demerits of Planar Transmission lines.
2. Sketch the impedance variation and Standing Wave pattern when a line is terminated in short circuit.
3. How can a transmission line be used as a (i) capacitance (ii) inductance.
4. What are the features of a Quarter Wave Transformer.
5. When the far end of a transmission line is short circuited the impedance measured at the sending end is 4.61 ohms resistive and when that is open circuited, the input becomes 1390 ohms resistive. Calculate the characteristic impedance.
6. Can TEM waves exist in hollow waveguides? Give reasons for your answer.
7. What is meant by dominant mode in waveguides?
8. With neat sketch show the excitation methods for TE and TM modes in rectangular waveguides.
9. Compare the features of ordinary transmission lines and hollow waveguides.
10. Bring out the significance of Quality factor in resonators.

PART-B **(5x 16 = 80 marks)**

11. Obtain the differential equation governing the variation of voltage and current along a transmission line and obtain its solution. Give the physical interpretation of these equations derived.

12. a) Derive the expression that will help you to predict the filter performance and hence derive the design equations for constant k low pass filter. Draw the variation of attenuation and phase with respect to frequency for a low pass section.

(OR)

12.b) (i) Bring out the relationship between Neper and Decibel **(4)**

(ii) When are two networks said to be inverse to each other. Prove by suitable example. **(4)**

(iii) Obtain the design equations of a Lattice attenuator **(8)**

13. a) A 50 Ω lossless line is terminated in an unknown load. The distance between adjacent voltage minima is d=8 cm, the VSWR is equal to 2, and the first voltage minimum is situated at d_m = 1.5cm from the load. What is the value of Z_L. Design a single stub matching network (frequency of operation is 1.875 GHz) for the Z_L computed. (Use smith Chart)

(OR)

13. b) The terminating impedance Zt is 100+j100Ω, and the characteristic impedance Zo of the line and stub is 50Ω . The first stub is placed at 0.40λ away from the load. The spacing between the two stubs is ¾ λ. Determine the length of the short-circuited stubs when the match is achieved. What terminations are forbidden for matching the line by the double-stub device?

14. a)(i) Starting from Maxwell's Equation obtain the expressions for various components of Electric and Magnetic filed strengths assuming propagation in Z direction, in parallel planes. **(10)**

(ii) Sketch the Electric and Magnetic fields between parallel planes for TE_{10} and TM_{10} waves. **(6)**

(OR)

14. b) A hollow rectangular waveguide has width a = 4cm height b = 2.6cm, operating at 7GHz. Compute the following for possible modes.

(i) cut-off wavelength **(4)**

(ii) Guide wavelength, phase constant and phase velocities **(4)**

(iii) Wave impedances for TE and Tm modes. **(6)**

15. a) Derive the field components for TM waves in cylindrical waveguides.

(OR)

15. b) (i) A rectangular cavity resonator has dimensions of a = 5cm, b= 2 cm, and d=15cm. Compute:

a) The resonant frequency of the dominant mode for an air-filled cavity. **(4)**

b) The resonant frequency of the dominant mode for a dielectric-filled cavity of ε_r = 2.56. **(4)**

(ii) Explain in detail the formation, excitation and working of cavity resonators. Draw the Equivalent circuit of a resonator. **(8)**