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Question Paper Code : 13355

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2012.

Fifth Semester

Electronics and Communication Engineering

080290031 — TRANSMISSION LINES AND WAVEGUIDES

(Regulation 2008)

Time : Three hours Maximum: 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. How can frequency and delay distortions be avoided?

2. Define characteristic impedance of transmission line.

3. What are the disadvantages of single stub matching?

4. Find the standing wave ratio of a 50 ohms transmission line when it is terminated by load impedance of 90+j60 ohms.

5. What are electric waves?

6. Write down the expressions of cut-off frequency for TE wave.

7. Why do waveguides take circular or rectangular form?

8. Calculate the cut-off wavelength for dominant mode in a rectangular waveguide whose a=3cm.

9. Define dominant mode of cavity resonator.

10. What are the performance parameters of microwave resonator?

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) State and explain Campbell's formula for the loading cables. (8)

(ii) A telephone line has a resistance of 20 ohms, inductance of 10mH, capacitance of $0.1 \mu F$ an insulation resistance of 100 K ohm/m. Find the input impedance at angular frequency 5000 radians/s, if the line is very long. (8)

Or

(b) (i) Show that a line will be distortionless if CR=LG. (8)

(ii) Explain in detail T and π section equivalent to lines. (8)

12. (a) (i) Derive the expression for voltages and currents on the dissipationless line. (8)

(ii) Explain in detail how the location and length of the stub are determined using reflection coefficient (8)

Or

(b) (i) A SWR on a lossless line is found to be 5 and the successive voltage minimum are 40cm apart. The first voltage minimum is observed to be 15cm from the load. The length of the line is 160cm and the characteristics impedance 300Ω. Using Smith chart determine

(1) The load impedance

(2) The sending end impedance. (10)

(ii) What are the features of a quarter wave transformer? Discuss its properties. (6)

13. (a) (i) Explain the characteristics of TE, TM and TEM waves. (8)

(ii) Prove that $V_g V_p = C^2$. (8)

Or

(b) (i) For a frequency of 6GHz and plane separation of 7cm, find the following for the TE mode.

(1) cut-off frequency

(2) angle of incidence of the plances

(3) phase velocity

(4) group velocity

(5) Is it possible to propagate the TE2 mode? (10)

(ii) What are the different types of velocities of propagation in between two plates? Explain. (6)

14. (a) (i) A rectangular waveguide has cross-section dimensions a=7cm and b=4cm. Determine all the modes which will propagate through the waveguide at a frequency of 6GHz. (8)

(ii) Design a rectangular waveguide with filling by a dielectric of ε_r=4, so that the cut-off frequency for the dominant mode is 14GHz and the cut-off frequency for TM_{11} mode is 30GHz. (8)

Or

(b) (i) Using the wave equation, derive from first principles the transverse field components for the TM_{mm} mode. Hence obtain the wave impedance for a rectangular waveguide. (8)

(ii) Define characteristic impedance of a rectangular waveguide and derive its expressions in three forms. (8)

15. (a) (i) Calculate the cut-off wavelength, the guide wavelength and the characteristic wave impedance of a circular waveguide whose internal diameter is 5cm, for a 6GHz signal that propagates it in the dominant TE_{11} mode. (8)

(ii) Explain how various modes can be excited in a circular waveguide. (8)

Or

(b) Derive expressions for the field components of TE wave in a cavity resonator. Mention the application of cavity resonator. (16)
