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Question Paper Code : 31264

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

11.5.13-FN

Fifth Semester

Electronics and Communication Engineering

080290031 – TRANSMISSION LINES AND WAVEGUIDES

(Regulation 2008)

Time : Three hours Maximum : 100 marks

(Smith Chart is to be provided)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. For a transmission line with incident voltage of 5 V and reflected voltage of 3 V, determine the reflection coefficient and SWR.

2. For a given length of coaxial cable with a distributed capacitance C = 48.3 pF/m, a distributed inductance L = 241.56 nH/m and a relative dielectric constant $\varepsilon_r = 2.3$, determine the velocity of propagation.

3. A quarter wave transformer is connected directly to a $50\,\Omega$ load to match this load to a transmission line whose characteristic impedance is $75\,\Omega$. What must be the characteristic impedance of the matching transformer?

4. Write the applications of one eighth wave and half wave lines.

5. Differentiate : TE and TM waves.

6. A wave is propagating at 6 GHz between parallel planes with separation of 3 cm in the dominant mode. Calculate the characteristic wave impedance.

7. Determine the group velocity of TE_{11} mode in a rectangular waveguide with a = 7.2cm and b = 3.2cm at 6 GHz.

8. Write the characteristics of TEM waves.

9. What are the advantages and disadvantages of circular waveguides?

10. List the applications of circular and semicircular cavity resonators.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Derive general expressions for the input impedance of a transmission line and deduce necessary expression when the line is terminated in its characteristic impedance (10)

(ii) A transmission line has the following parameters: R = 6 Ω/km, L = 2.2 mH/km, C = 0.005 μF/km and G = 0.05×10^{-6} mho/km. Determine the attenuation and phase shift introduced by the line to a signal at a frequency of 1 KHz, if the line length is 100km. (6)

Or

(b) (i) Derive the condition for the distortionless operation of a transmission line. (8)

(ii) The attenuation on a 50 Ω distortionless line is 0.01 dB/m. The line has a capacitance of 0.1 nF/m. Determine the resistance, inductance and conductance of the line. (8)

12. (a) (i) Derive expressions for the voltage and current on a lossless transmission line. (10)

(ii) Determine the input impedance and SWR for a transmission line 1 .25λ long with a characteristic impedance of 50 Ω and a load impedance of (30+j40) Ω. (6)

Or

(b) (i) Explain the principle of double stub matching and discuss its advantages. (8)

(ii) A 300 Ω transmission line is connected to a load impedance of (450-j600) Ω at 10 MHz. Find the position and length of a short circuited stub required to match the line. Use Smith Chart. (8)

13. (a) (i) Describe the transmission of TM waves between parallel perfectly conducting planes with necessary expressions for the field components. (12)

(ii) Discuss the wave impedances of TE and TEM waves between parallel planes. (4)

Or

(b) (i) Explain the attenuation of TE and TM waves between parallel planes with necessary expressions and diagrams. (12)

(ii) Discuss the velocities of propagation of TE and TEM waves between parallel planes. (4)

14. (a) Describe the propagation of TE waves in a rectangular waveguide with necessary expressions for the field components and also plot the field configurations for the TE_{10} and TM_{11} modes. (16)

Or

(b) (i) Give a brief note on the attenuation of TE and TM modes in a rectangular waveguide. (10)

(ii) A rectangular air filled waveguide of dimensions a = 6 cm and b = 4 cm is operated at 3 GHz in the TM_{11} mode. Find the cutoff frequency, wavelength in the waveguide and wave impedance in the waveguide. (6)

15. (a) (i) Discuss the propagation of TM waves in a circular waveguide with relevant expressions and diagrams for the field components. (10)

(ii) Discuss the excitation of modes in circular waveguides. (6)

Or

(b) (i) Explain the principle and operation of rectangular cavity resonators. (12)

(ii) Give a brief note on the dominant mode in a circular waveguide. (4)

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