Reg. No. :

Question Paper Code : 41213

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

Fifth Semester

Electronics and Communication Engineering

EC 1303 – TRANSMISSION LINES AND WAVEGUIDES

(Regulation 2008)

(Smith Chart is to be provided)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. A transmission line with a characteristic impedance of 300 Ω is fed by a generator of impedance 100 Ω. The line length is 100 m and is terminated by a resistive load of 200 Ω. Calculate the reflection loss in dB.

2. Write the equations for the attenuation and phase constants of a telephone cable operating in the audio range of frequencies.

3. A lossless transmission line has a shunt capacitance of 100 pF/m and a series inductance of 4 μH/m. Determine the characteristic impedance.

4. Give the applications of λ/8 and λ/4 lines.

5. Distinguish 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 cutoff wavelength and frequency.

7. Mention the characteristics of TEM waves.

8. Determine the characteristic impedance of TM_{11} mode in a rectangular waveguide with a = 9 cm and b = 4.5 cm at 3 GHz.

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

10. Bring out the relationship between quality factor and Bandwidth of a resonator.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive expressions for the input and transfer impedances of a transmission line. (12)

(ii) An open wire transmission line has R = 10 Ω/km, L = 0.0037 H/km, G = 0.4 × 10^{-6} mhos/km and C = 0.0083 × 10^{-6} F/km. Determine the attenuation and phase constants at a frequency of 1000 Hz. (4)

Or

(b) (i) What are the types of waveform distortion in a transmission line? Derive the condition for the distortionless operation of a transmission line. (12)

(ii) A lossless transmission line of length 0.434λ and characteristic impedance 100 Ω is terminated in an impedance of (260+180) Ω. Find the voltage reflection coefficient and SWR. (4)

12. (a) (i) Design a single stub matching Network for the following Data (use SMITH CHART)

$Z_L \rightarrow$ load impedance = 400 + j200 Ω

$Z_o \rightarrow$ characteristic impedance = 300 Ω.

Use short circuited shunt stubs. Specify the VSWR values before and after the connection of stubs.

(ii) Sketch the input impedance variation and standing wave pattern when a transmission line is terminated in a

(1) Short circuit

(2) Open circuit.

Or

(b) Design a double stub matching Network for the following data. Normalised value of load admittance $y_l = 1.23 - j0.51$. Distance between the stubs is 0.4λ and distance from load to first stub is 0.1λ. Use shunt stubs which are short circuited at the far end. Indicate the forbidden regions (use SMITH CHART).

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

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

Or

(b) (i) Explain briefly the attenuation of TE and TM waves between parallel planes with necessary expressions and diagrams. (10)

(ii) Discuss the wave impedances of TE, TM and TEM waves between parallel planes. (6)

14. (a) (i) Describe the propagation of TM waves in a rectangular waveguide with necessary expressions for the field components. (12)

(ii) A waveguide has an internal breadth a = 3cm and carries the dominant mode of a signal of unknown frequency. If the characteristic wave impedance is 500 Ω, determine the unknown frequency. (4)

Or

(b) (i) Give a brief note on the dominant mode and impossibility of TEM mode in a rectangular waveguide. (8)

(ii) Discuss the excitation of different modes in a rectangular waveguide. (8)

15. (a) Discuss the propagation of TE waves in a circular waveguide with relevant expressions and also discuss the dominant mode. (16)

Or

(b) (i) Explain the principle, operation and applications of rectangular cavity resonators. (10)

(ii) Give a brief note on the excitation of different modes in a circular waveguide. (6)

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