Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 51242

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

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. What is the minimum value that the characteristic impedance of an air-dielectric parallel wire line could have?

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

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

4. Write the features of dissipationless lines.

5. Define uniform plane waves.

6. Compare the characteristics of TE and TM waves.

7. A rectangular waveguide has a = 6 cm and b = 4 cm. The signal frequency is 3 GHz. Determine the cutoff frequency for TM_{11} mode.

8. Write the important features of TEM waves.

9. A rectangular cavity resonator has dimensions of a = 5cm, b = 2cm and d = 15 cm. Compute the resonant frequency of the dominant mode.

10. Write the applications of circular and semicircular cavities.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Derive expressions for the input and transfer impedances of a transmission line. (10)

(ii) A transmission line has R = 10.4 Ω/km, L = 3.66 mH/km, C = 0.00835 μF/km and G = 0.08×10^{-6} mhos/km. Determine the attenuation and phase constants at 5000 radians per second. (6)

Or

(b) (i) Derive the conditions for distortionless operation of a transmission line. (10)

(ii) Explain the T and ∏ section equivalent to transmission lines. (6)

12. (a) (i) Describe the technique of single stub matching with necessary diagrams and equations. Write its disadvantages. (10)

(ii) Calculate the length of a short circuited line required to tune out the susceptance of a load whose admittance is Y = (0.004 – j 0.002) Siemens, placed on an air-dielectric transmission line of characteristic admittance V_0 = 0.0033 Siemens at a frequency of 150 MHz using Smith chart. (6)

Or

(b) (i) Describe the technique of double stub matching with necessary equations and diagrams and also discuss its advantages. (8)

(ii) Calculate the position and length of a short circuited stub to match a (180 + j120) Ω load to a 300 Ω transmission line using relevant formula. (8)

13. (a) (i) Explain the transmission of TE waves between parallel planes with *necessary equations.* *(10)*

(ii) Write a brief note on velocities of propagation of the waves between parallel planes. (6)

Or

(b) (i) Explain the attenuation of TE and TM waves in parallel plane guides. (10)

(ii) Write a brief note on wave and characteristic impedances. (6)

14. (a) Describe the propagation of TM waves in a rectangular waveguide with necessary expressions for the field components and also plot the field configurations for the dominant mode. (16)

Or

(b) (i) Discuss the excitation of various modes in rectangular waveguides. (6)

(ii) Discuss the impossibility of TEM waves in waveguides. (6)

(iii) Calculate the voltage attenuation provided by a 25 cm length of waveguide having a = 1 cm and b = 0.5 cm, in which a I GHz signal is propagated in the dominant mode. (4)

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

(ii) A $TE_{1,1}$ mode is propagating through a circular waveguide. The radius of the guide is 5 cm and the guide contains an air dielectric. Calculate the cutoff wavelength, guide wavelength and characteristic wave impedance at 3 GHz. (6)

Or

(b) (i) Explain the principle and operation of rectangular cavity resonators and discuss the Q factor for TE_{101} mode. (12)

(ii) Discuss the mode excitation in circular waveguides. (4)
