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Question Paper Code : 11207

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Fifth Semester

Electronics and Communication Engineering

EC 1303 – TRANSMISSION LINES AND WAVEGUIDES

(Regulations 2008)

Time : Three Hours **Maximum : 100 Marks**

(Smith Chart is to be provided)
Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Determine the characteristics impedance of a coaxial cable operating at extremely high frequencies with L = 483.12 nH/m and C = 24.15 pF/m.

2. Write the equations for the characteristics impedance and propagation constant of a telephone cable.

3. How can smith chart be used as an admittance chart ?

4. State the expressions for inductance L and capacitance C of a open wire line.

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. Obtain the expression for cutoff wavelength of a standard rectangular waveguide in TM_{11}, mode.

8. A rectangular waveguide measures 3 × 4.5 cm internally and has a 9 GHz signal propagate in it. Determine the cutoff frequency of the wave guide in TE_{10} mode.

9. What are the various types of resonators ?

10. Define Q factor of a cavity resonator.

PART – B (5 × 16 = 80 marks)

11. (a) (i) Derive the transmission line differential equations and obtain the general solutions for the voltage and current on the transmission line. **(10)**

(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. **(6)**

OR

(b) (i) Derive expression for the attenuation constant (α) and phase constant (β) of a transmission line in terms of R, L, G and C. **(8)**

(ii) A transmission line has R = 6 Ω/km, L = 2.2 mH/km, C = 0.005 μF/km and G = 0.05 micromho/km. Determine the characteristic impedance, attenuation and phase constants at KHz. **(8)**

12. (a) (i) A transmission line of length 0.40 λ has a characteristic impedance of 100 Ω and is terminated in a load impedance of 200+J180Ω, Find the

(1) Voltage reflection coefficient

(2) Voltage standing wave ratio

(3) Input impedance of the line **(10)**

(ii) Describe an experimental setup for the determination of VSWR of an RF transmission. **(6)**

OR

(b) (i) A line of $Z_0 = 300\ \Omega$ is connected to a load of 73 Ω, for a frequency of 40 MHZ. Find the length and the location of the nearest load of a single stub to produce an impedance match. **(8)**

(ii) What are impedance matching devices ? Write short notes on eighth line and half line. **(8)**

13. (a) Explain the transmission of TM waves between parallel planes with necessary equations. Discuss the characteristics of TE and TM waves between parallel planes. **(16)**

OR

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

(ii) Discuss the velocity of propagation and wave impedances of different modes propagating 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) (i) Obtain the solution of field equations in cylindrical co-ordinates. **(8)**

(ii) A circular waveguide has an internal diameter of 5 cm. Calculate the cutoff frequencies for the following modes TM_{11} and $TM_{12}((ha)_{11} = 3.832$ and $(ha)_{12} = 7.106)$. **(8)**

OR

(b) (i) What is a cavity resonator ? Derive an expression for the frequency of oscillation of rectangular cavity resonator. **(10)**

(ii) A metal box is of 3cm × 4 cm × 5cm size. If it is filled with air, find the resonant frequency for TE_{102}. **(6)**
