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Question Paper Code : X 20451

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Fifth/Fourth Semester
Electronics and Communication Engineering
EC 6503 – TRANSMISSION LINES AND WAVE GUIDES
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Smith Chart to be permitted
Answer ALL questions

PART – A **(10×2=20 Marks)**

1. State the line parameters of a transmission line.
2. What is a distortionless line ? Give the condition for a distortionless line.
3. Define Standing Wave Ratio.
4. A lossless line has a characteristic impedance of 400 Ω. Determine the standing wave ratio if the receiving end impedance is 800 + j0.0 Ω.
5. What is an impedance matching in stub ?
6. What are the uses of Smith Chart ?
7. Determine the value of L required by a constant-K T-section high pass filter with a cut off frequency of 1 KHz and design impedance of 600 Ω.
8. What are the advantages of m-derived filters ?
9. Justify, why TM_{01} and TM_{10} modes in a rectangular waveguide do not exit.
10. An air-filled rectangular waveguide of inner dimensions 2.286 × 1.016 in centimeters operates in the dominant TE_{10} modes. Calculate the cut-off frequency and phase velocity of a wave in the guide at a frequency of 7 GHz.

PART – B **(5×13=65 Marks)**

11. a) Derive the general transmission line equations for voltage and current at any point on a line. **(13)**

(OR)

b) A communication line has L = 3.67 mH/km, G = 0.08×10^{-6} ʊ/km, C = 0.0083 μF/km and R = 10.4 Ω/km. Determine the characteristic impedance, phase constant, velocity of propagation, wavelength, sending end current and receiving end current for given frequency f = 1000 Hz, sending end voltage is 1 volt and transmission line length is 100 kilometers. **(13)**

12. a) i) Derive an expression for the input impedance of a dissipationless line and also find the input impedance is maximum and minimum at a distance 's'. **(6)**

ii) Find the sending end line impedance for a HF line having characteristic impedance of 50 Ω. The line is of length (1.185λ) and is terminated in a load of (110 + j80) Ω. **(7)**

(OR)

b) i) Describe an experimental set up for the determination of VSWR of an RF transmission. **(7)**

ii) Briefly explain on :

1) Standing waves **(3)**

2) Reflection loss. **(3)**

13. a) 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 using Smith Chart.

(OR)

b) i) A load impedance of 90-j50 Ω is to be matched to a line of 50 Ω using single stub matching. Find the length and position of the stub. **(9)**

ii) Design a quarter wave transformer to match a load of 200 Ω to a source resistance of 500 Ω. The operating frequency is 200 MHz. **(4)**

14. a) Derive the relevant equations of m derived low pass filter and design m derived T type low pass filter to work into the load of 600 Ω and cut off frequency a 5 KHz and peak attenuation at $f_\infty = 1.25\ f_c$. **(13)**

(OR)

b) Design a constant K. T section bandpass filter with cut off frequencies of 1KHz and 4 KHz. The design impedance is 600 ohms. **(13)**

15. a) A rectangular air-filled copper waveguide with dimension 0.9 inch × 0.4 inch cross section and 12 inch length is operated at 9.2 GHz with a dominant mode. Find cut-off frequency, guide wave-length, phase velocity, characteristics impedance and the loss.

(OR)

b) i) Using Bessel function derive the TE wave components in circular wave guides. **(7)**

ii) Calculate the resonant frequency of an air filled rectangular resonator of dimensions a = 2 cm, b = 4 cm and d = 6 cm operating in TE_{101} mode. **(6)**

PART – C **(1×15=15 Marks)**

16. a) Derive the field component of a Transverse Electric wave in rectangular wave guides. **(15)**

(OR)

b) For a frequency of 10 GHz and plane separation of 5 cm in air, find the cut off frequency, cut off wavelength, phase velocity and group velocity of the wave. **(15)**