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**Question Paper Code : 51456**

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

**Fifth Semester**

**Electronics and Communication Engineering**

**EC 2305/EC 55/10144 EC504 – TRANSMISSION LINES AND WAVEGUIDES**

**(Regulations 2008/2010)**

**(Common to PTEC 2305 – Transmission Lines and Waveguides for B.E. (Part-Time) Fourth Semester Electronics and Communication Engineering – Regulations 2009)**

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

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

**PART – A (10 × 2 = 20 Marks)**

1. Design a T-type attenuator to operate into a load of 600 Ω with an attenuation of 60 dB.

2. Determine the value of capacitance required for a constant-K II-section low pass filter with a cutoff frequency of 2 kHz. The terminating load resistance is 600 Ω.

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

4. A transmission line has a characteristic impedance of 300 Ω and is terminated in a load of (150 +j 150) Ω. Calculate the reflection coefficient .

5. What is meant by a dissipationless line ?

6. Mention the drawbacks of single stub matching.

7. What are the features of TEM waves ?

8. A wave is propagated in the dominant mode in a parallel plane waveguide. The frequency is 6 GHz and the plane separation is 4 cm. Calculate the cutoff wavelength and the wavelength in the waveguide.

9. An air filled rectangular waveguide has a = 6 cm and b = 4 cm. The signal frequency is 3 GHz. Determine the cutoff frequency for $TM_{11}$ mode.

10. What are the commonly used guide terminations ?

## PART – B

**Answer ALL questions (5 × 16 = 80 marks)**

11. (a) (i) Describe the design and operation of constant-K band pass filter with neat diagrams. **(8)**

(ii) Design a band elimination filter (T-section) with cutoff frequencies of 2 kHz and 6 kHz. The design impedance is 600 Ω. **(6)**

(iii) Compare constant-K and m-derived filters. **(2)**

**OR**

(b) (i) Explain the principle and operation of crystal filters with necessary diagrams. **(8)**

(ii) Design a symmetrical lattice attenuator to have a characteristic impedance of 600 Ω and attenuation of 20 dB. **(6)**

(iii) Determine the value of 'm' required for an m-derived low pass filter having cutoff frequency of 1000 Hz and resonant frequency of 1100 Hz. **(2)**

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

(ii) A telephone line has R = 6 Ω/km, L = 2.2 mH/km, C = 0.005 μF/km and G = $0.05 \times 10^{-6}$ mho/km. Determine the characteristic impedance and propagation constant at 1 kHz. **(6)**

**OR**

(b) (i) What are the types of waveform distortion introduced by a transmission line ? Derive the conditions for the distortionless operation of a transmission line. **(12)**

(ii) A telephone cable is 64 km long. This cable has R = 13 Ω /km and C = 0.008 μF/km. Calculate the attenuation and phase constants at 1000 Hz and also the velocity of propagation. **(4)**

13. (a) (i) Derive expressions for the input impedance of open and short circuited lines operating at radio frequencies. **(10)**

(ii) A transmission line of 100 m long is terminated in a load of (100-j200) Ω. Determine the line impedance at 25 m from the load end at a frequency of 10 MHz. The characteristic impedance of the line is 100 Ω. Determine the input impedance using Smith chart. **(6)**

**OR**

(b) (i) Explain the principle and technique of single stub matching with necessary diagrams and expressions. **(10)**

(ii) A 300 Ω transmission line is connected to a load impedance of (450-j600) Ω. Find the position and length of a short circuited stub required to match the line at a frequency of 10 MHz using Smith chart or relevant formula. **(6)**

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

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

**OR**

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

(ii) Write a brief note on wave velocities and impedances. (4)

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

(ii) An air filled rectangular waveguide of dimensions a = 7cm and b = 3.5 cm operates in the dominant mode. Find the guide wavelength and phase velocity at a frequency of 3.5 GHz. (4)

**OR**

(b) (i) Discuss the principle of operation and applications of resonant cavities. (10)

(ii) Explain the excitation of various modes in rectangular cavities. (6)

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