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**Question Paper Code : 57294**

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

**Fifth Semester**

**Electronics and Communication Engineering**

**EC 6503 – TRANSMISSION LINES AND WAVE GUIDES**

**(Regulations 2013)**

**Time : Three Hours**

**Maximum : 100 Marks**

**(Normalised Smith chart is to be provided)**

**Answer ALL questions.**

**PART – A (10 × 2 = 20 Marks)**

1. What is characteristics impedance ?
2. Define reflection loss.
3. What are the assumptions to simplify the analysis of line performance at high frequencies ?
4. Write the expression for standing wave ratio in terms of reflection co-efficient.
5. Why a quarter wave line is considered as a impedance inverter ? Justify.
6. What is a stub ? Why it is used in between transmission lines ?
7. What are the major draw backs of a constant – k prototype filter ?
8. Why a composite filter is designed and what are the various sections of the composite filter ?
9. Define dominant mode. What is the dominant mode of a rectangular wave guide ?
10. How a cavity resonator is formed ?

**PART - B (5 × 16 = 80 Marks)**

11. (a) (i) Derive the transmission line equation and hence obtain expression for voltage and current on a transmission line. (10)
- (ii) Prove that an infinite line equal to finite line terminated in its characteristic impedance. (6)

**OR**

- (b) A generator of 1 V, 1000 Hz supplies power to a 100 km open wire line terminated in  $Z_0$  and having following parameters

$$R = 10.4 \text{ ohm per km} \quad G = 0.8 \times 10^{-6} \text{ mho per Km}$$

$$L = 0.00367 \text{ Henry per Km} \quad C = 0.00835 \text{ } \mu\text{F per Km}$$

Calculate  $Z_0$ ,  $\alpha$ ,  $\beta$ ,  $\lambda$ ,  $v$ . Also find the received power. (16)

12. (a) (i) Derive the line constants of a zero dissipationless line. (8)
- (ii) A line with zero dissipation has

$$R = 0.006 \text{ ohm per m} \quad C = 4.45 \text{ pF per m}$$

$$L = 2.5 \text{ } \mu\text{H per m}$$

If the line is operated at 10 MHz find  $R_0$ ,  $\alpha$ ,  $\beta$ ,  $\lambda$ ,  $v$ . (8)

**OR**

- (b) (i) Discuss in detail about the variation of Input Impedance along open and short circuit lines with relevant graphs. (10)
- (ii) A loss less line has a Standing Wave ratio of 4. The  $R_0$  is 150 ohms and the maximum voltage measured in the line is 135 V. Find the power delivered to the load. (6)

13. (a) (i) Prove that the input impedance of a quarter wave line is  $Z_{in} = R_0^2/Z_R$ . (6)
- (ii) Design a quarter wave transformer to match a load of 200 ohms to a source resistance of 500 ohms. Operating frequency is 200 MHz. (10)

**OR**

- (b) A load (50 - j 100) ohms is connected across a 50 ohms line. Design a short circuited Stub to provide matching between the two at a signal frequency of 30 MHz using Smith chart. (16)



14. (a) (i) Derive the design equations of a constant k low pass filter. (8)
- (ii) A  $\pi$  section filter network consists of a series arm inductance of 20 mH and two shunt capacitor of 0.16  $\mu$ F each. Calculate the cut off frequency, attenuation and phase shift at 15 KHz. What is the value of nominal impedance in the pass band ? (8)

OR

- (b) Design a low pass composite filter to meet the following specifications  $f_c = 2000$  Hz,  $f_\infty = 2050$  Hz,  $R_k = 500$  ohms. (16)
15. (a) Derive the field component of a Transverse Electric wave in Rectangular wave guides. (16)

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. (16)