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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 ohm per km G = 0.8×10^{-6} mho per Km

L = 0.00367 Henry per Km C = 0.00835 μF per Km

Calculate Z_0, α, β, λ, 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 ohm per m C = 4.45 pF per m

L = 2.5 μH per m

If the line is operated at 10 MHz find Ro α, β, λ, 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 $Zin = R_0^2/ZR$. (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 π section filter network consists of a series arm inductance of 20 mH and two shunt capacitor of 0.16 μF 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_∞ = 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)