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Question Paper Code : 50445

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Fifth Semester
Electronics and Communication Engineering
EC 6503 – TRANSMISSION LINES AND WAVE GUIDES
(Regulations 2013)

Time : Three Hours Maximum : 100 Marks

Note : Use Smith chart wherever necessary

Answer ALL questions

PART – A (10×2=20 Marks)

1. Define characteristic impedance.
2. State the condition for a distortion less line.
3. Why is a quarter wave line called an impedance inverter ?
4. What is an impedance matching in stub ?
5. What is the nature and value of Z_0 for the dissipation less line ?
6. What are nodes and antinodes on a line ?
7. Define – Decibel.
8. What are called constant–k filters ?
9. What is dominant mode ?
10. Write the expression for cutoff wavelength of the wave which is propagated in between two parallel planes.

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) Derive the input impedance Z_0 from the transmission line equation and also find voltage reflection ratio at the load. (13)

12. a) Calculate the average input power at a distance from the load 'ℓ' and find the impedance when the load is short circuited, open circuited and for a matched line. (13)

(OR)

b) i) A 30 m long lossless transmission line with $Z_0 = 50\Omega$ operating at 2 MHZ is terminated with a load $Z_L = 60 + j40$. If $u = 0.6c$ (c is velocity of light, u is phase velocity) on the line, find

a) The reflection coefficient Γ. (2)

b) The standing wave ratio s. (2)

c) The input impedance. (3)

ii) Draw the input impedance pattern for a lossless line when short circuited and open circuited. (6)

13. a) Antenna with impedance $40 + j\,30\Omega$ is to be matched to a 100Ω lossless line with a shorted stub. Determine the following using Smith chart. (13)

a) The required stub admittance.

b) The distance between the stub and the antenna.

c) The stub length.

d) The standing wave ratio on each of the system.

(OR)

b) Design a double-stub shunt tuner to match a load impedance $Z_L = 60 - j80\Omega$ to a 50Ω line. The stubs are to be short-circuited stubs and are spaced $\lambda/8$ apart. Find the lengths of the two stubs using Smith chart. (13)

14. a) Sketch the reactance curve and derive the steps to design a constant – K low pass filter. Determine attenuation constant and phase constant in pass band and stop band and plot it. (13)

(OR)

b) Design a m-derived T type low pass filter connected to a load of 500Ω with cutoff frequency 4 KHZ and peak attenuation at 4.15 KHZ. (13)

15. a) Derive the field equations of TE waves travelling in Z direction in a rectangular wave guide. (13)

(OR)

b) An air filled resonant cavity with dimensions a = 5 cm, b = 4 cm and c = 10 cm is made of copper ($\sigma_c = 5.8 \times 10^7$ mhos/m). Find the resonant frequencies of

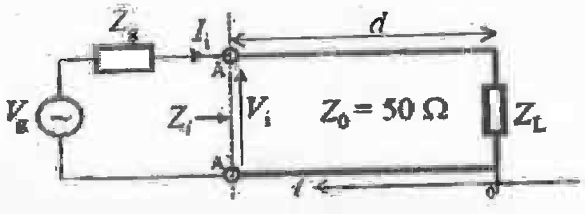
a) The five lowest order modes. (7)

b) The quality factor TE_{101} mode. (6)

PART – C

(1×15=15 Marks)

16. a) A lossless transmission line with $Z_0 = 50\Omega$ and d = 1.5 m connects a voltage Vg source to a terminal load of $Z_L = 50 + j50\Omega$. If Vg = 60 v, operating frequency f = 100 MHz and $Zg = 50\Omega$, find the distance of the first voltage maximum ℓ_M from the load and what is the power delivered to the load P_L? Assume the speed of the wave along the transmission line equal to speed of light C. (15)



(OR)

b) Examine the effectiveness of Bessel's differential equation and Bessel function with reference to waveguides. (15)