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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
- The reflection coefficient Γ . (2)
 - The standing wave ratio s . (2)
 - 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 $40 + j30 \Omega$ is to be matched to a 100Ω lossless line with a shorted stub. Determine the following using Smith chart. (13)
- The required stub admittance.
 - The distance between the stub and the antenna.
 - The stub length.
 - 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)

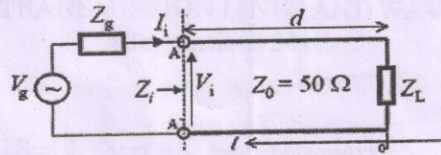
- b) An air filled resonant cavity with dimensions $a = 5$ cm, $b = 4$ cm and $c = 10$ cm is made of copper ($\sigma_c = 5.8 \times 10^7$ mhos/m). Find the resonant frequencies of
- The five lowest order modes. (7)
 - The quality factor TE_{101} mode. (6)



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 V_g source to a terminal load of $Z_L = 50 + j50 \Omega$. If $V_g = 60$ v, operating frequency $f = 100$ MHz and $Z_g = 50 \Omega$, 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)