31/10/17
FN

Reg. No. : | | | | | | | | | | | | |

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 $100\,\Omega$ 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 $50\,\Omega$ 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 $500\,\Omega$ 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)

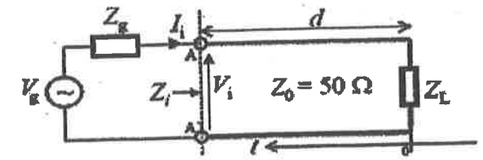
b) An air filled resonant cavity with dimensions a = 5 cm, b = 4 cm and c = 10 cm is made of copper ($\sigma_c = 5.8 \times 10^7$ mhos/m). Find the resonant frequencies of

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)**