Q.2a. Illustrate the condition of reciprocity and symmetry in Z-parameter representation.

Ans : Page 472-473 , Article 14.8 (i) of text book I

b. Explain with the help of diagram the phenomenon of standing waves in open and short circuit lines.

Ans : Page 37-38 , Article 2.2 (i) & (ii) of text book I

Q.3a. At t = 0, a pulse of width a is applied to the RL network of Fig 3. Determine the expression for the current i(t) using Laplace transformation.

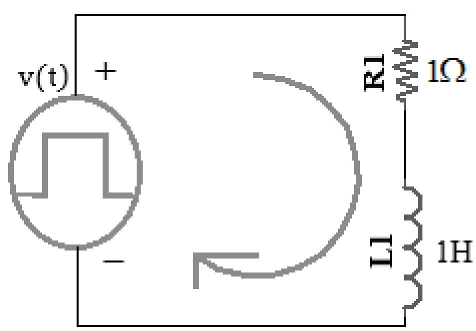


Fig. 3

3a $V(s) = 1/s\ (1-e^{-as})$

Substitute this value of V(s) into the transform equation

$L[sI(s) - i(0+)] + RI(s) = I/s(1- e^{-as})$

Substituting the element values and the intial condition , i(0+)=0 gives

$I(1-e^{-as})/s(s+1)$

The first term after expansion

$1/s(s+1) = 1/s - 1/1+s$

So $I(s) = 1/s - 1/s+1 - e^{-as}/s + e^{-as}/s+1$

After The inverse laplace transformation

$I(t)= (1-e^{-t})u(t)-[1-e^{t-a}]u(t-a)$

b. Find the Laplace transform of **(8)**

(i) Unit Step Function

(ii) Exponential Function

Ans Article 6.2 of text book I

Q.4 a. State Thevenin theorem and find the current in the resistance of 5ohm as shown in circuit in Fig.4. **(8)**

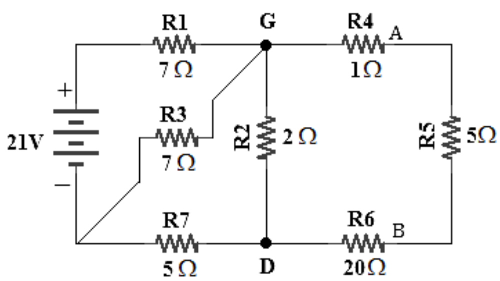


Fig. 4

4a

When AB is open The main current flowing from 21V battery is given by

$$I = \frac{21}{7 + \frac{7 \times (5+2)}{7+5+2}} = 2 \text{ amp}$$

Voc= Vth= drop across resistance 2Ω = $\frac{2X7}{14}$ x2 = 2V

To find Rth Battery is replaced with short circuit

Rth= [(7 II 7 +5)II 2] 1.0 +20

=22.62 Ω

And current through 5 Ω resistance = IL = $\frac{21}{22.62+5}$ A =0.76 A

b. State superposition theorem and determine the current through each resistor.**(8)**

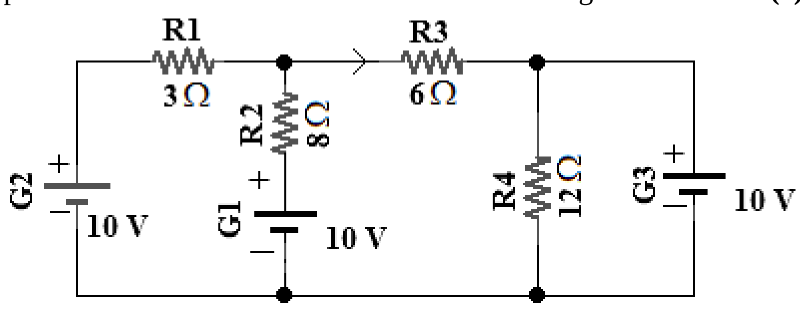


Fig.5

4b 1) E1 is used first , other source are shorted

12 resistance become shorted

I'_1 = current through 3Ω resistance

I'_2 = current through 8Ω resistance

I'_3 = current through 6Ω resistance

$$I'_1 = \frac{E1}{(6||8)+3} = 1.56\ A$$

$$I'_2 = 1.56 \times \frac{6}{6+8} = 0.67\ A$$

I'_3 = 1.56-0.67 =0.89 A

ii) Now E2 is used other source shorted

I''_1 = current through 3Ω resistance

I''_2 = current through 8Ω resistance

I''_3 = current through 6Ω resistance

I''_2 = E2/(3||6) +8 = 10/10 =1 A

I''_1 = 1X 6/6+3 = 0.67 A

I''_3 = 1-0.67 =0.33 A

Now E3 is retained only other two sources are shorted

I'''_1 = current through 3Ω resistance

I'''_2 = current through 8Ω resistance

I'''_3 = current through 6Ω resistance

I'''_4 = current through 12Ω resistance

I'''_5 = current through load

$$I'''_5 = \frac{E3}{[(3||8) + 6]||(12)} = 10/4.86 = 2.06$$

I'''_4 = E3/12= 10/12 =0.835A

I'''_3 =2.06 -0.885= 1.225A

I'''_2 = 1.225 X 3/3+8 =0.334A

$I'''_1 = I'''_3 - I'''_2 = 1.225 - 0.334 = 0.891A$

Hence utilizing superposition theorem

Current through 3Ω resistance = $I'_1 + (-I''_1) + (-I'''_1) = 0$ A

Current through 8Ω resistance = $I'_2 - I''_2 + I'''_2 = 0$ A

Current through 6Ω resistance = $I'_3 + I''_3 - I'''_3 = 0$ A

Current through 12Ω resistance = 0.835 A

Q.5 a. Explain the effect of resistance on the frequency response for RLC circuit.

Ans- Text Book book I Chapter No. 19

b.Explain how impedance of a parallel resonant circuit varies with frequency?

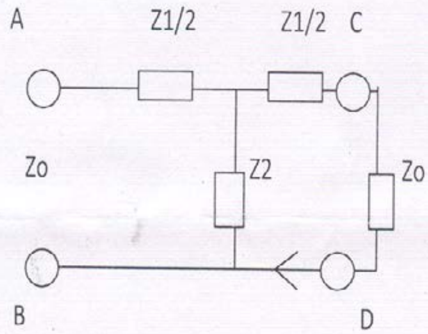
Ans- Text Book book I Chapter No. 19

c.Show that the frequency of resonance in a parallel RLC circuit differ from that of a series RLC circuit.

Ans- Text Book book I Chapter No. 19

Q.6a. Derive an expression of characteristics impedance Z_0 of symmetrical T section. (8)

6 a)



As shown in fig Symmetrical T section that has net series arm impedance Z1 and shunt arm impedance Z2 .Each half of the series arm thus has impedance Z1/2

Let Zo is characteristic impedance of the n/w section and is terminated at one side(c d)

$$Zo = Z1/2 + \frac{Z2(Zo+Z1/2)}{(Z2+Zo+Z1/2)}$$

After rearranging $Zo= Zi^2+4Z1Z2$

$$Zo=\sqrt{\frac{Zi^2}{4}+Z1Z2}$$

$Zo= \sqrt{Z1Z2(1+Z1/4Z2)}$ Ans

b. Derive an expression for the open and short circuit impedance of a symmetrical T network in terms of arm impedance.

6b As from above T network fig

$Zo/c = Z1/2 + Z2$ equation 1

Squaring this equation

$Zoc^2 = (Z1^2/4 + Z1Z2) + Z2^2$

$= Zo^2 + Z2^2$

$= Zoc \times Zsc + Z2^2\ 4$

$Z2 = \sqrt{Zoc(Zoc - Zsc)}$ equation2

Substitute the value of Z2 in equation 1

$Zoc = Z1/2 + \sqrt{Zoc\,(Zoc - Zsc)}$

So $Z1 = 2[Zoc - \sqrt{Zoc\,(Zoc - Zsc)}\,]$ Ans

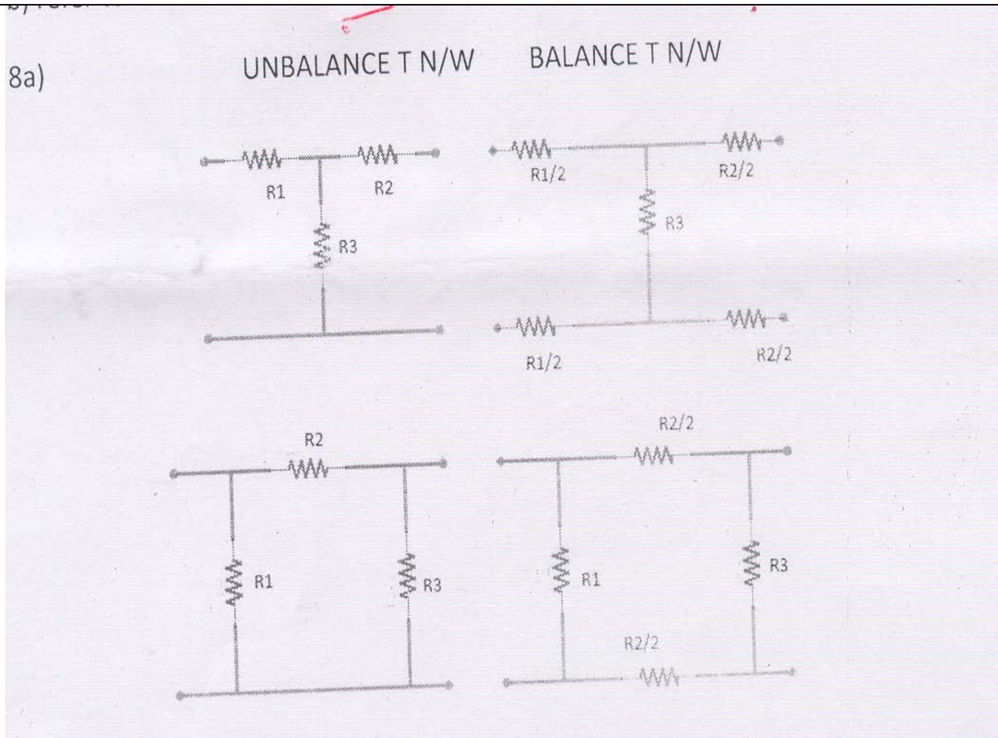
Q.7 a. The Z parameters of a two port network are Z_{11} = 10 ohms, Z_{22} =20 ohms, $Z_{12} = Z_{21}$ = 5 ohms.
(i) Find the ABCD parameters
(ii) Also find the equivalent T-network

Ans Text Book book I, Page No. 483, para 14.10.

b.What is Reflection Coefficient? Derive the relation between VSWR and Reflection Coefficient.

Ans Text book I, Chapter 06

Q.8 a. Draw the balance and unbalance circuit for T and π network.



b. Design a 'T' type symmetrical attenuator which offers 40dB attenuation with a load of 400Ω.

8 b)

UNBALANCE ∏ N/W BALANCE ∏ N/W

Attenuation in dB = 40 dB

Load impedance =Ro =400 Ω

Series Arm resistance R1

Shunt arm resistance =R2

Input current/output current =N

D = 20 log10 N(dB)

N= Antilog 10(D/20)

N= Antilog 10(40/20)

=100

For symmetrical T section

R1= Ro(N-1/N+1)

= 400(99/101)

=392.08Ω

R2= Ro(2N/N^2-1)

= 8.001 Ω Ans

c. Design a constant K low pass filter having f_c = 2kHz and design impedance R_o = 600 Ω. Obtain the value of attenuation at 4 kHz

8c) The value of the elements of constant K low pass filter are

The series arm inductance

L= Ro/∏fc = 600/∏x2x1000 = 95.493 H

Shunt capacitance C= 1/∏fcRo = 0.265 uF

Let attenuation at 4 KHz be α where α is given by

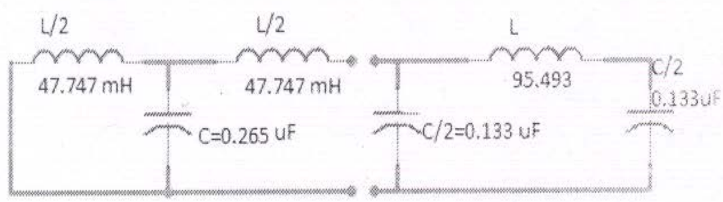
$\alpha = 2\cosh^{-1}(f\alpha/fc)$

$= 2\cosh^{-1}(4000/2000)$

= 2.634 nepers

The required T and ∏ section low pass filter is shown below

T section ∏ section



Q.9 Write Short note on the following: (8×2)

(i) Losses in transmission Line

(ii) Smith Chart and its Application

(I)

9 a)There are mainly three type of losses in transmission lines

1 radiation loss : These losses occurs when lines are separated to larger distance. The lines acts as antenna and start radiating the signal which cause the loss of signal. This types of losses occurs in open wire lines

2. Dielectric Loss: It is the loss of energy within the medium between conductor.The loss of energy is due to the leakage current because of finite conductivity of dielectric. The energy loss is dielectric appears as heat. These losses increasing with frequency

3. Copper losses: It is due to resistance of the conductor . It is the energy loss in the form of heat which is being dissipated in the surrounding medium by the line conductor.

(ii) refer text book I article no. 6.6 & 6.8

Text Book

1. Transmission Lines and Networks; Umesh Sinha, 8th Edition; Reprint 2004, Satya Prakashan, Incorporating Tech India Publications, New Delhi