Set No. 1

I B.Tech Supplimentary Examinations, Aug/Sep 2008
ELECTRICAL CIRCUITS
(Common to Electrical & Electronic Engineering, Electronics & Control Engineering and Instrumentation & Control Engineering)

Time: 3 hours   **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is the difference between an ideal source and a practical source? Draw the relevant characteristics of the above sources.

   (b) Explain the difference between active elements and passive elements with suitable examples.

   (c) Determine the current through 6Ω resistor and the power supplied by the current source for the circuit shown in figure 1c.   [6+4+6]
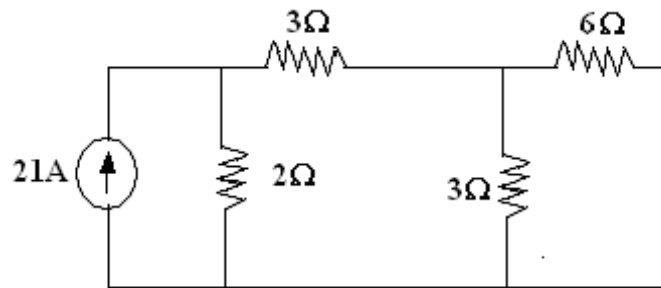

Figure 1c

2. (a) Write short notes on dot convention used in magnetically coupled coils.

   (b) In the network shown in figure 2b, L_1=1H, L_2=2H, M=1.2H. Assuming the inductance coils to be ideal, find the amount of energy stored after 0.1 see of the circuit connected to a d.c.source of 10V.   [6+10]
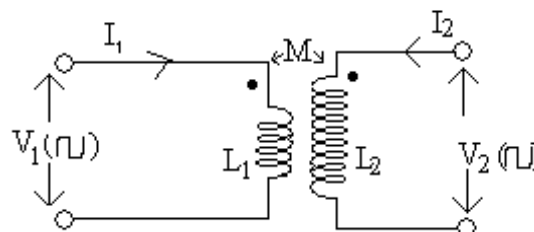

Figure 2b

3. (a) Define the following:

   i. RMS value

   ii. Average Value and

   iii. Form factor of an alternating quantity.

   (b) A series circuit consisting of a 10 ohm resistor, a 100 μF capacitance and a 10mH inductance is driven by a 50Hz a.c. voltage source of max. value 100

volts. Calculate the equivalent impedance, current in the circuit, the power factor and power dissipated in the circuit. Also, draw the vector diagram.

[6+10]

4. (a) Two wattmeters are used to measure power in a 3-phase three wire load. Determine the total power, power factor and reactive power, if the two wattmeters read

     i. 1000w each, both positive

     ii. 1000w each, but of opposite sign.

(b) What is phase sequence? Explain its significance?

(c) What are the advantages of a poly phase system over a single phase system.

[8+4+4]

5. (a) Explain the procedure for obtaining fundamental tie-set matrix of a given network.

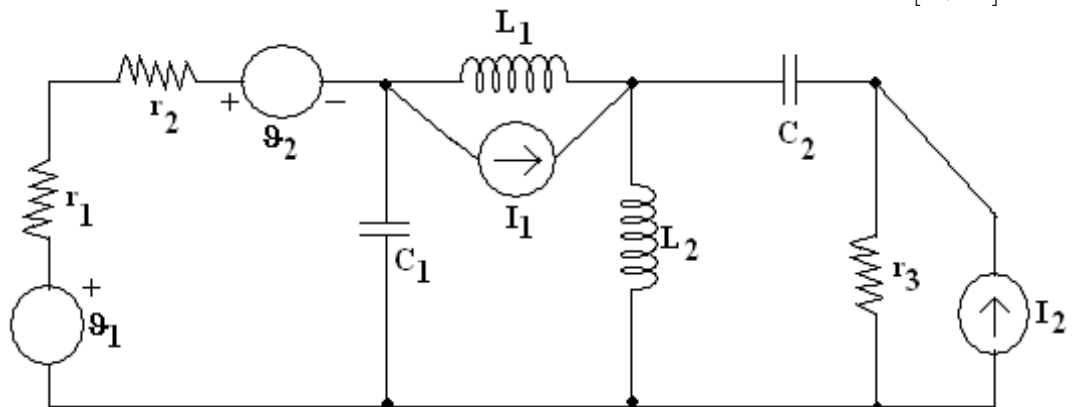(b) Draw the oriented graph of the network shown in figure 5b and write the incidense matrix. [6+10]

Figure 5b

6. (a) State and explain compensation theorem.

(b) In the network shown in figure 6b, find the value of Z_L so that the power transfer from the source is maxi mum. Also find P_{max}. [8+8]
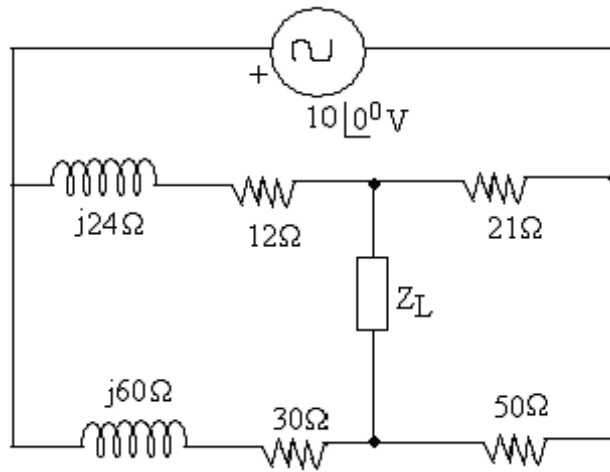
Figure 6b

7. Find ϑ_c (t) at t = 0 + while the switching is done from x to y at t = 0. As shown in figure 7 [16]
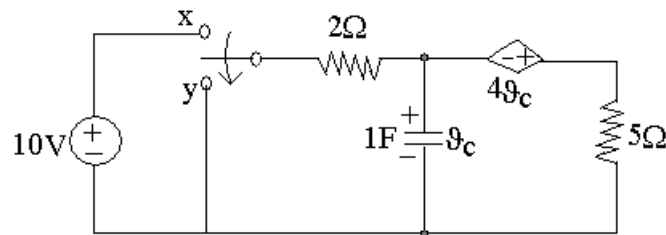

Figure 7

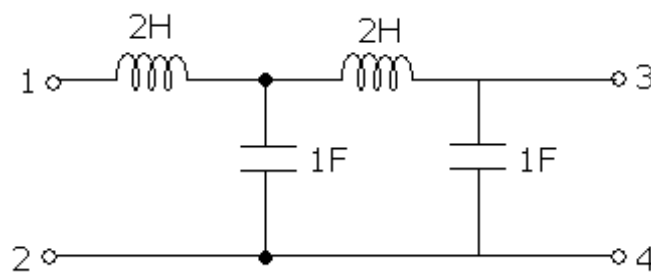8. Determine the transmission parameters of the network shown in figure 8. [16]

Figure 8

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Set No. 2

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Time: 3 hours   **Max Marks: 80**
Answer any FIVE Questions
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1. (a) Define the following

    i. Resistance
    ii. Inductance
    iii. Capacitance Also, Give the $v - i$ relationship for the above elements.

   (b) A capacitor of 1F is supplied with a voltage wave form shown in figure 1b. Obtain the current and energy wave forms in the capacitor.
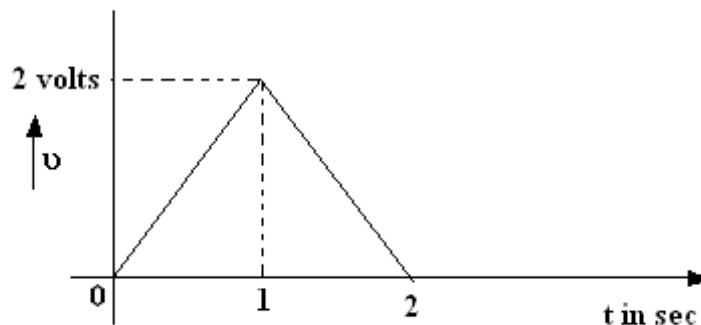

Figure 1b

   (c) A current $i = 10\ e^{-t}$ is applied to a 2H inductor. What is the respective voltage across inductor?   [16]

2. (a) Bring out an analogy between magnetic circuits and electric circuits.

   (b) Define:

    i. Permeability and
    ii. Magnetic flux.

   (c) A ring shaped electromagnet has an air gap of 6mm and 20 cm^2 in area, the mean length of the core being 50cm and its cross section is 10 cm^2. Calculate the ampere-turns required to produce a flux density of 0.5 Wb/m^2 in the gap. Assume the permeability of iron is 1800.   [6+4+6]

3. (a) Bring out the differences between series and parallel resonance?

   (b) A series RLC circuit consists of resistance R = 20Ω, inductance, L=0.01H and capacitance, C = 0.04 μF. Calculate the frequency at resonance. If a 10 Volts of frequency equal to the frequency of resonance is applied to this circuit, calculate the values of V_C and V_L across C and L respectively. Find the frequencies at which these voltages V_C and V_L are maximum?   [6+10]

4. (a) Show that two wattmeters are sufficient to measure power in a 3-phase circuit. Derive the expressions for wattmeter readings for a balanced 3-phase load.

(b) Three similar resistors are connected in star across 450 V, 3-phase lines. The line current is 10 Amps. If the same resistors are connected in delta across the same supply, calculate

    i. Phase current

    ii. Line current

    iii. The power consumed.   [8+8]

5. For the graph shown in figure 5, find the tie-set and cut-set matrices and obtain KCL and KVL equations. (Assume any missing data)   [16]
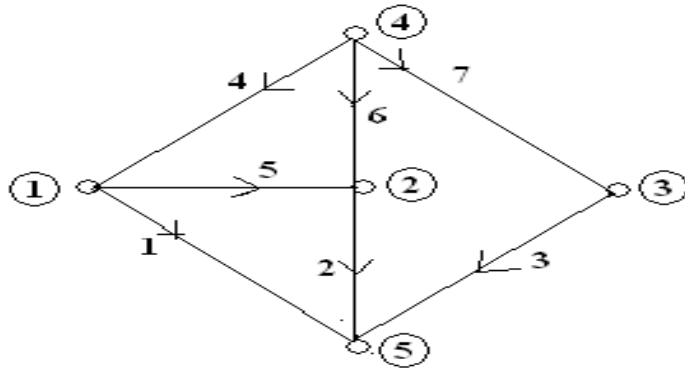
Figure 5

6. (a) State and explain compensation theorem.

(b) In the network shown in figure 6b, find the value of Z_L so that the power transfer from the source is maxi mum. Also find P_{max}.   [8+8]
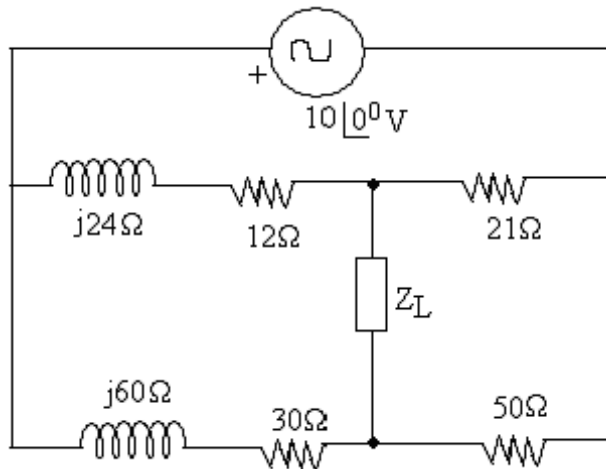

Figure 6b

7. As shown in figure 7 represents a parallel RLC circuit where R =0.1Ω, L = 0.5H and C is 1F. Capacitor C has an initial voltage of 12V as per the polarity shown in figure. The switch K is closed at time t = 0. Obtain ϑ(t).   [16]
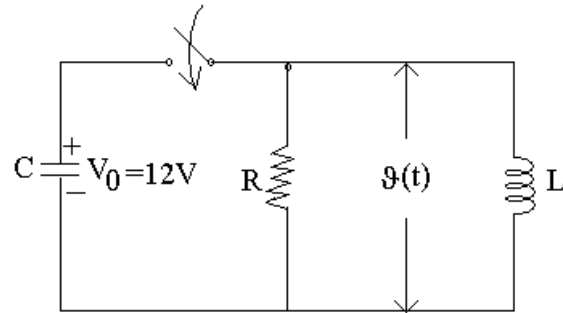
Figure 7

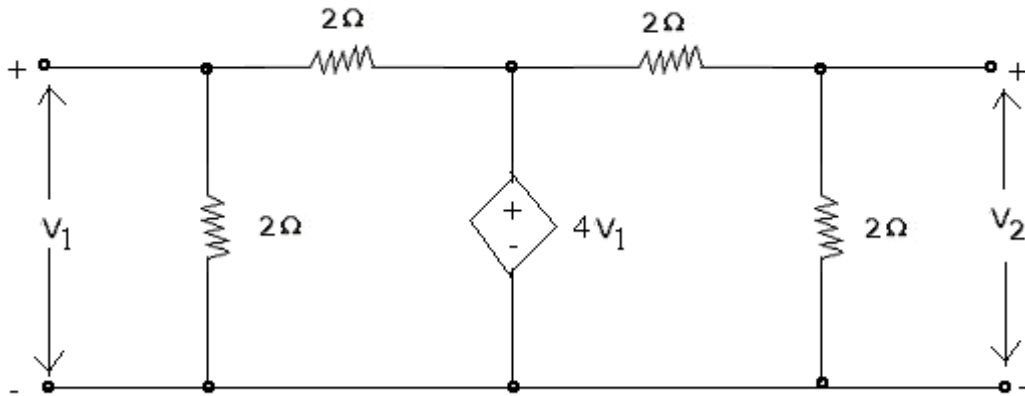8. Determine the Z-parameters for the resistive network shown in figure 8. [16]

Figure 8

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$\boxed{\textbf{Set No. 3}}$

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Time: 3 hours   Max Marks: 80
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1. (a) For the circuit shown in figure 1a, find the current through 20Ω resistor?

Figure 1a

(b) Reduce the network shown in figure 1b, to a single loop network by successive source transformation, to obtain the current in the 12Ω resistor.   [8+8]
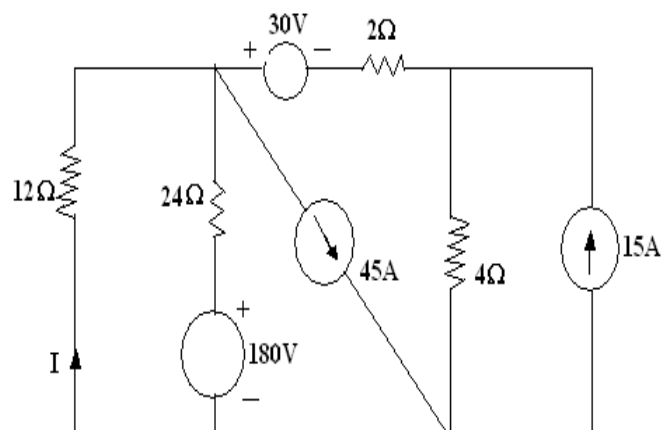

Figure 1b

2. (a) Define
    i. MMF
    ii. Flux
    iii. Reluctance.

(b) An iron ring of mean length 50cms has an air gap of 1mm and a winding of 200turns. If relative permeability of iron is 300 when a current of 1A flows through the coil, find the flux density?

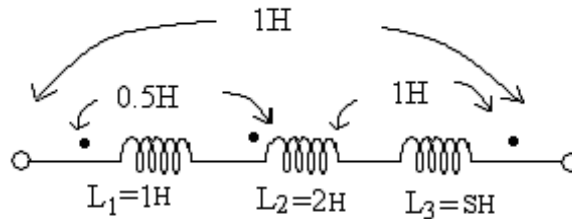(c) Find the total inductance of the three series connected coupled coils as shown in figure 2c. [6+6+4]

Figure 2c

3. (a) Explain the following:-

   i. Impedance
   ii. Reactance
   iii. Phase angle difference
   iv. Power factor

(b) An alternating voltage (80 + j60) v is applied to a circuit and current flowing is (-4 + j10) A. Find the

   i. impedance of the circuit and
   ii. the power factor.

(c) In a particular circuit a voltage of 10v at 25 Hz produces 100mA, while the same voltage at 75Hz produces 60mA. Draw the circuit diagram and insert the values of the constants. At what frequency will the value of impedance be twice that at 25Hz. [6+4+6]

4. (a) What is phase sequence? Explain its significance.

(b) A star connected three phase load has a resistance of 8 ohms and a capacitive reactance of 10 ohms in each phase. It is fed from a 400v, 3-ϕ balanced supply.

   i. Find the line current, total volt-amperes, active and reactive power
   ii. Draw phasor diagram showing phase voltages, line voltages and currents. [6+10]

5. (a) Explain the procedure for obtaining fundamental tie-set matrix of a given network.

(b) Draw the oriented graph of the network shown in figure 5b and write the incidense matrix. [6+10]
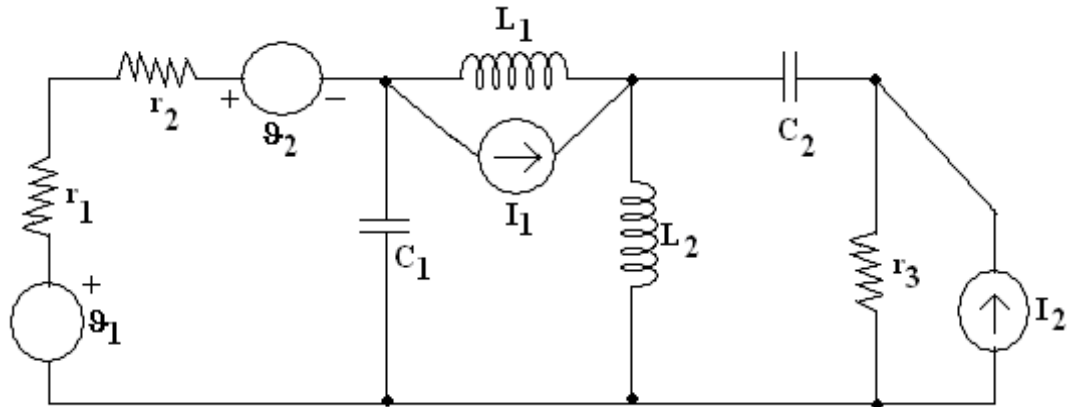
Figure 5b

6. (a) Explain the procedure used to solve a network problem using superposition theorem.

   (b) Find the current through 8Ω resistor using Thevenin's theorem. as shown figure 6b [8+8]
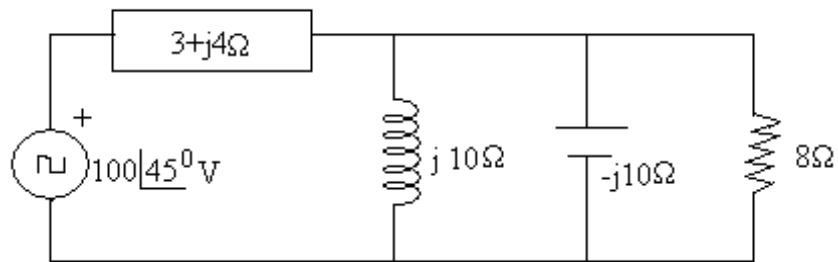

Figure 6b

7. (a) A dc voltage of 100V is applied in the circuit shown in figure 7a and the switch is kept open. The switch K is closed at t = 0. Find the complete expression for the current.
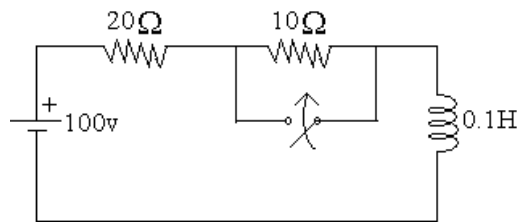

Figure 7a

   (b) A dc voltage of 20V is applied in a RL circuit where R = 5Ω and L = 10H. Find [8+8]

   i. The time constant
   ii. The maximum value of stored energy.

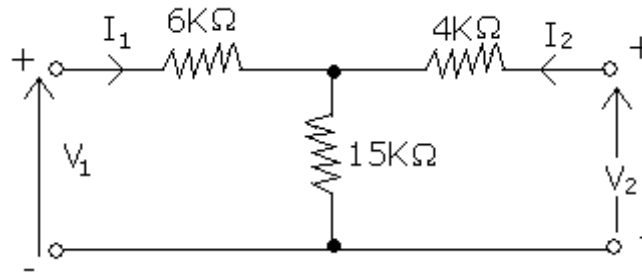8. (a) Find the Z-parameters for the network shown in figure 8a.

Figure 8a

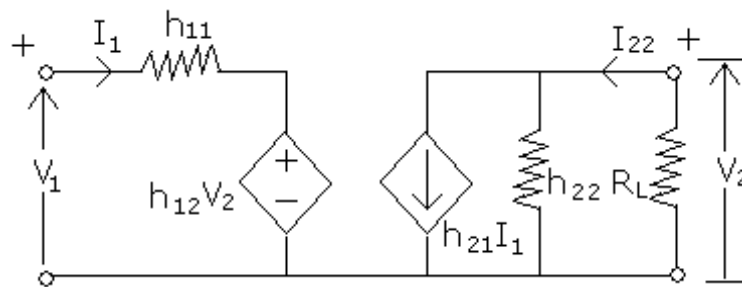(b) For the h parameter equivalent network shown in figure 8b find the voltage gain load resistance is R_L. [6+10]

Figure 8b

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Set No. 4

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Time: 3 hours   **Max Marks: 80**
Answer any FIVE Questions
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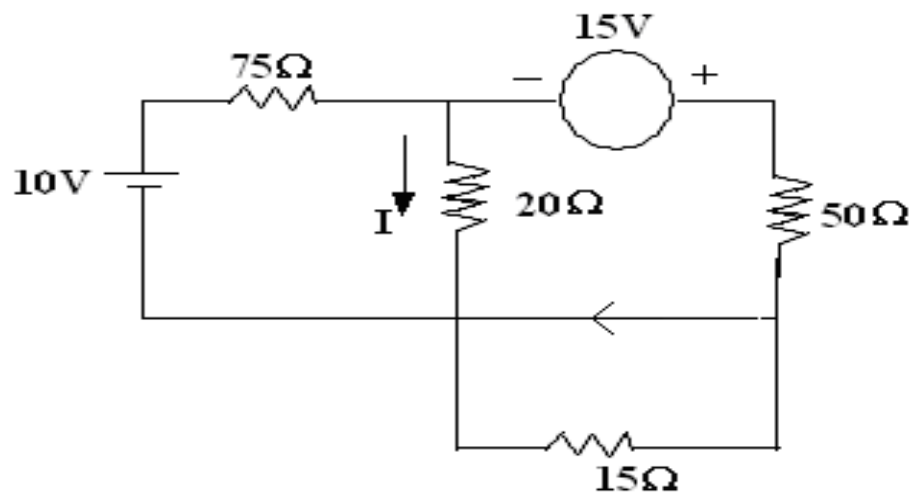1. (a) For the circuit shown in figure 1a, find the current through 20Ω resistor?

Figure 1a

(b) Reduce the network shown in figure 1b, to a single loop network by successive
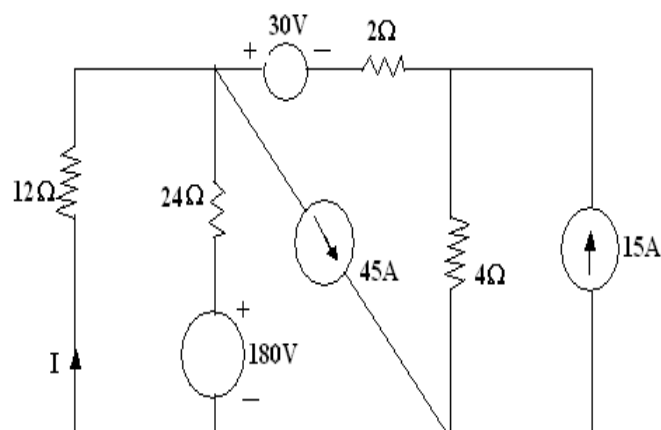source transformation, to obtain the current in the 12Ω resistor.   [8+8]

Figure 1b

2. (a) Solve for the currents I_1 and I_2 in the circuit shown in figure 2a. Also, find
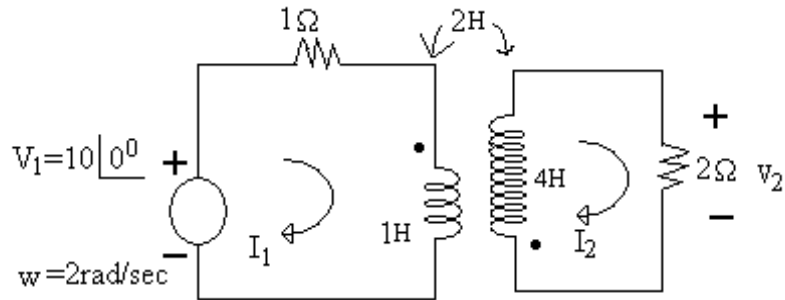the ratio of V_2/V_1.

Figure 2a

(b) What is magnetic circuit? Compare magnetic circuit with electric circuit in any four aspects. [10+6]

3. (a) The voltage of a circuit is $v = 200 \sin (wt + 30^o)$ and the current is $i = 50 \sin(wt + 60^o)$. Calculate [16]

    i. The average power, reactive volt-amperes and amparant power.

    ii. Find the circuit elements if w $=100\pi$ rad /sec.

(b) Find the form factor of the following waveform shown in figure 3b
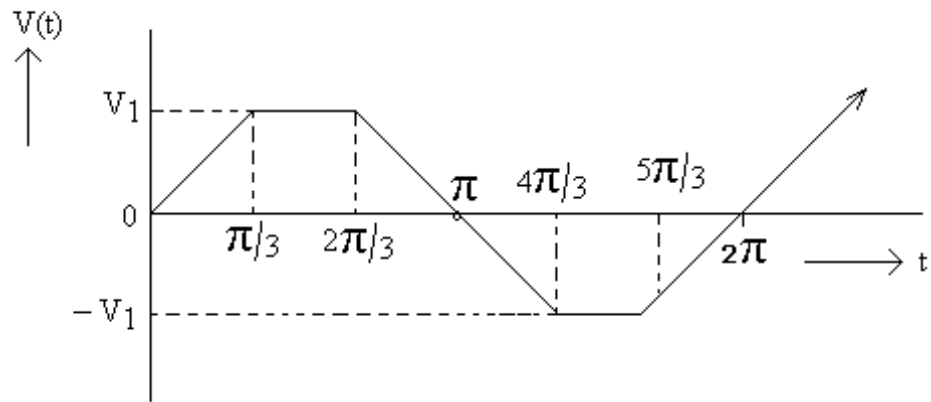

Figure 3b

4. (a) Two wattmeters are used to measure power in a 3-phase three wire load. Determine the total power, power factor and reactive power, if the two wattmeters read

    i. 1000w each, both positive

    ii. 1000w each, but of opposite sign.

(b) What is phase sequence? Explain its significance?

(c) What are the advantages of a poly phase system over a single phase system. [8+4+4]
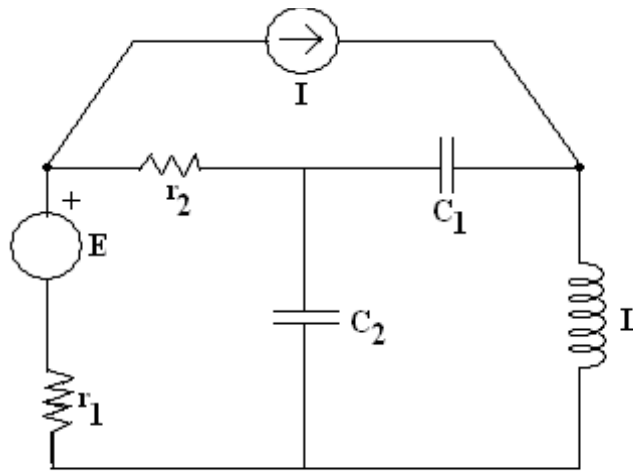
5. (a) Draw the graph of the network shown in figure 5a.

Figure 5a

(b) In the figure shown in figure 5b, find the current trough 5Ω resistor using mesh analysis. [6+10]
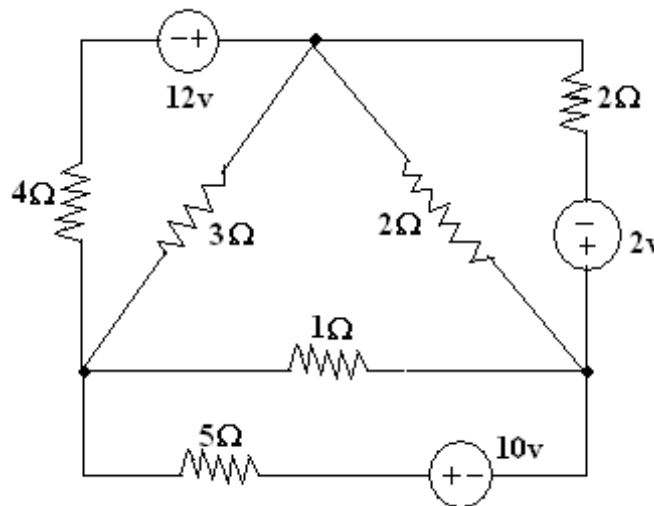

Figure 5b

6. (a) State and explain compensation theorem.

(b) In the network shown in figure 6b, find the value of Z_L so that the power transfer from the source is maxi mum. Also find P_{max}. [8+8]
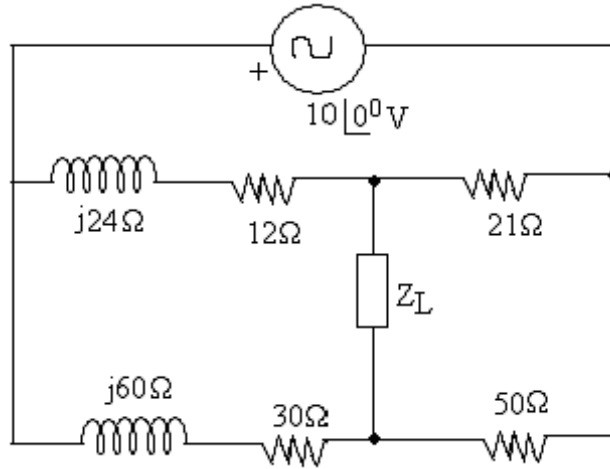
Figure 6b

7. (a) A dc voltage of 100V is applied in the circuit shown in figure 7a and the switch is kept open. The switch K is closed at t = 0. Find the complete expression for the current.
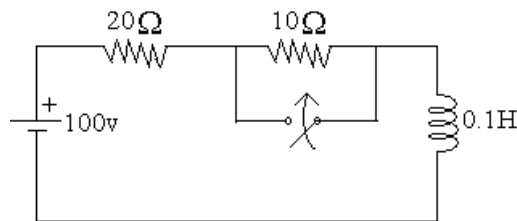

Figure 7a

(b) A dc voltage of 20V is applied in a RL circuit where R = 5Ω and L = 10H. Find   [8+8]

     i. The time constant

     ii. The maximum value of stored energy.

8. (a) Determine the Z-parameter of the network shown in figure 8a.
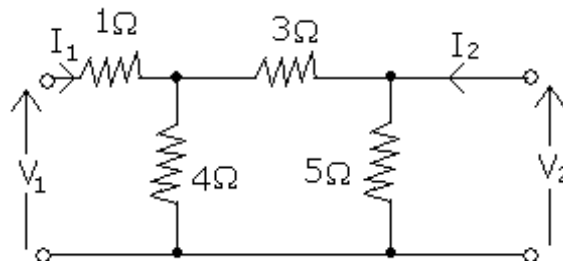

Figure 8a

(b) The y-parameters of a two port network are y_{11}=0.6 mho, y_{22}=1.2 mho and y_{12}=-0.3 mho.

     i. Determine the ABCD Parameters and

     ii. Equivalent Π network.   [8+8]

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