Code No: R161208 **R16** SET - 1

I B. Tech II Semester Regular/Supplementary Examinations, April/May - 2018
ELECTRICAL CIRCUIT ANALYSIS – I
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is Compulsory
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) State and explain Kirchoff's Laws. (3M)

   b) Define the following terms with example (2M)
   (i) Graph of a network
   (ii) Oriented graph

   c) Find the effective value of the inductance for the following connections as shown in figure 1(c). (3M)

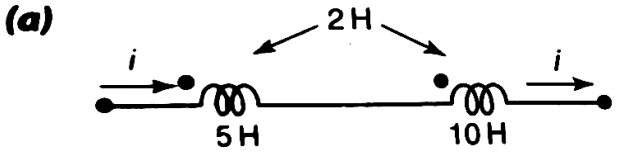

Figure 1(c)

   d) Calculate the current drawn by impedance. Z = (30- j70) Ω when voltage, V = 120 $\angle 0^0$ is applied across it. (2M)

   e) A series RLC circuit has the following parameter values R = 10 Ω, L = 0.01 H and C = 10 μF. Find the Q factor of the circuit at resonance. (2M)

   f) Is super position valid for power? Substantiate your answer. (2M)

PART –B

2. a) In the network shown in figure 2(a), determine the voltage V_b which results in a zero current through the (2+j3) Ω impedance branch. (9M)

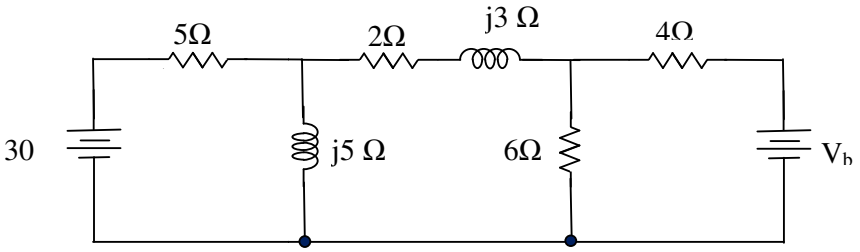

Figure 2(a)

   b) Determine the voltage V using source transformation and simplification for the circuit shown in figure 2(b). (5M)

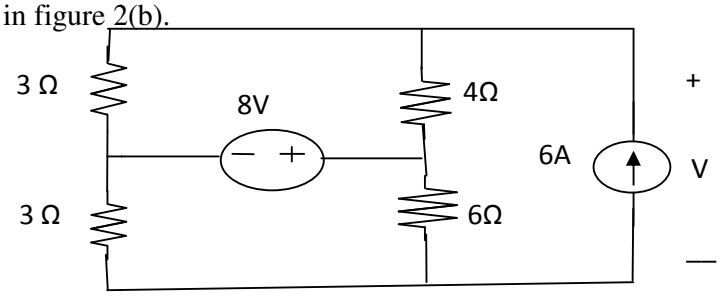

Figure 2(b)
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3. a) For the network shown in figure 3(a), draw the graph and write a tie-set schedule. Using the tie-set schedule obtain the loop equations. (10M)

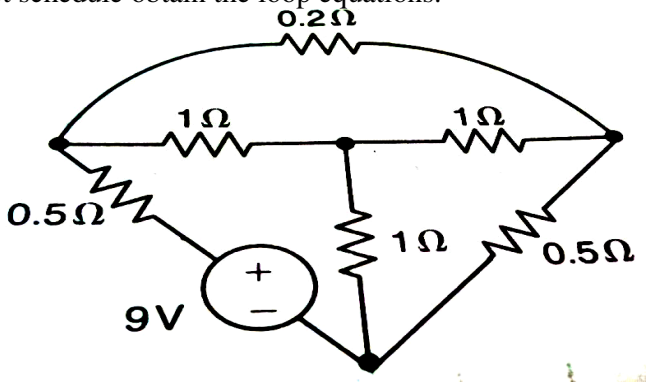

Figure 3(a)

b) For the network shown in figure 3(b), draw the graph and show some possible trees. (4M)

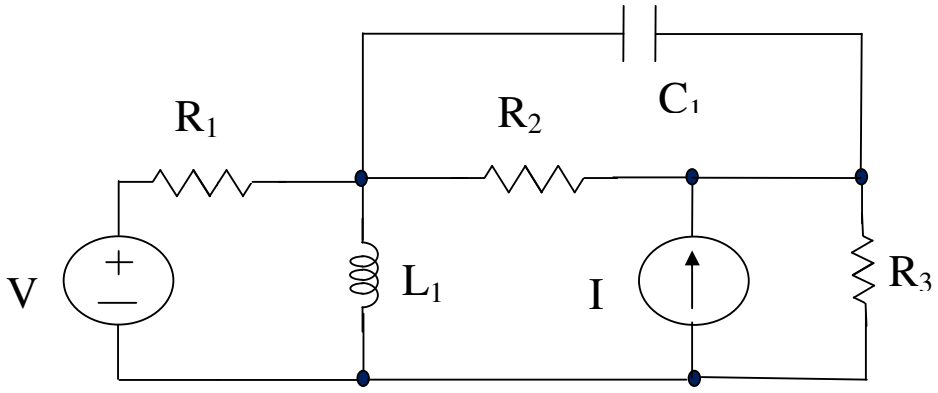

Figure 3(b)

4. a) A cast steel ring is wound with 500 turns. The cross – section of the core is 2 x 10^{-3} m^2 and the mean length is 0.16m. (a) Find value of I required to develop a magnetic flux of $\varphi = 4x\ 10^{-4}$ wb. (b) Determine the values of μ and μ_r for the material under these conditions. Assume H for cast steel = 170 At/m. (8M)

b) Draw the dotted equivalent circuit for the net work shown in below figure 4(b). and find the equivalent inductive reactance. (6M)

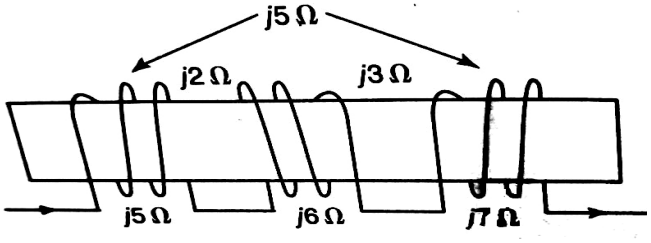

Figure 4(b)

5. a) Two coils of impedance 25.23 ∠ 37^0 and 18.65 ∠ 68^0 ohms are connected in series across a 230V, 50Hz supply. Find the total impedance, current, power factor, and active power. (7M)

b) Determine the rms value of a triangular wave in which the average rises uniformly from 0 to V volts and completes the cycle by falling instantaneously to zero. (7M)

6. a) For the circuit shown in figure 6(a). (7M)
(i) Determine the KVL equations.
(ii) Find the two loop currents I_1 , and I_2
(iii) Find the power supplied by the source and the power dissipated in each resistor.

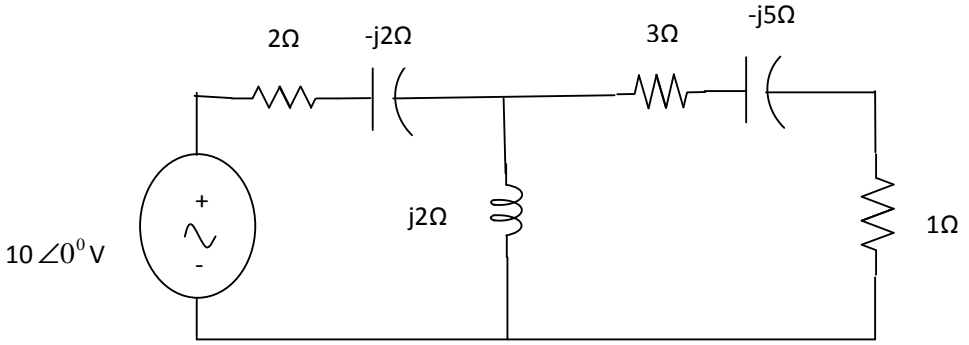

Figure 6(a)

b) A coil of 20 ohm resistance and an inductance of 0.2 H are connected in parallel with a capacitor of 100 μF. Determine the resonant frequency and the input impedance at resonance. (7M)

7. a) State and explain compensation theorem. (7M)

b) Find the value of R in the circuit shown in figure 7(b) such that maximum power transfer takes place. What is the amount of this power? (7M)

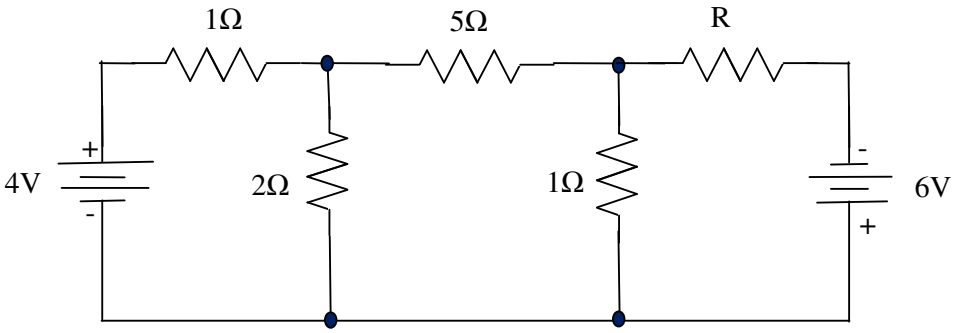

Figure 7(b)

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I B. Tech II Semester Regular/Supplementary Examinations, April/May - 2018
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3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Explain source transformation technique. (2M)

b) Define the following terms. (3M)
(i) Graph of the Network and Sub graph.
(ii) Rank of graph.

c) Find the effective value of the inductance for the following connections as shown in figure 1(c). (2M)

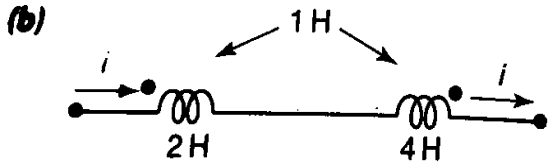

Figure 1(c)

d) A current I = $10\angle 30^0$ flows through an impedance, Z = $20\angle -22^0$ Ω find the average power delivered to the impedance. (2M)

e) A two element series circuit has a current of 4 cos $(200t + 13.2^0)$ amp flowing when the voltage of 200 sin $(2000t+50^0)$ volts is applied across its terminals. Determine the values of elements. (3M)

f) State Maximum power transfer theorem. (2M)

PART -B

2. a) Determine the node voltages V1, V_2, and $V_3$for the circuit shown in figure 2(a). (7M)

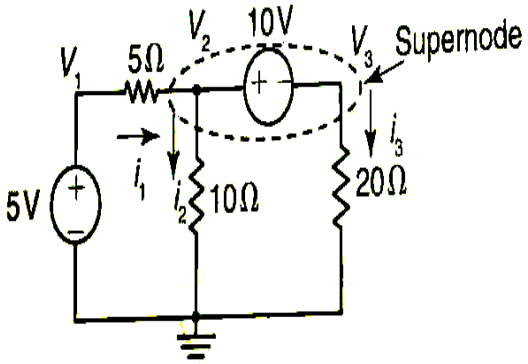

figure 2(a)
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b) Write the loop equations of the circuit as shown in figure 2(b) and find the voltage V_x. (7M)

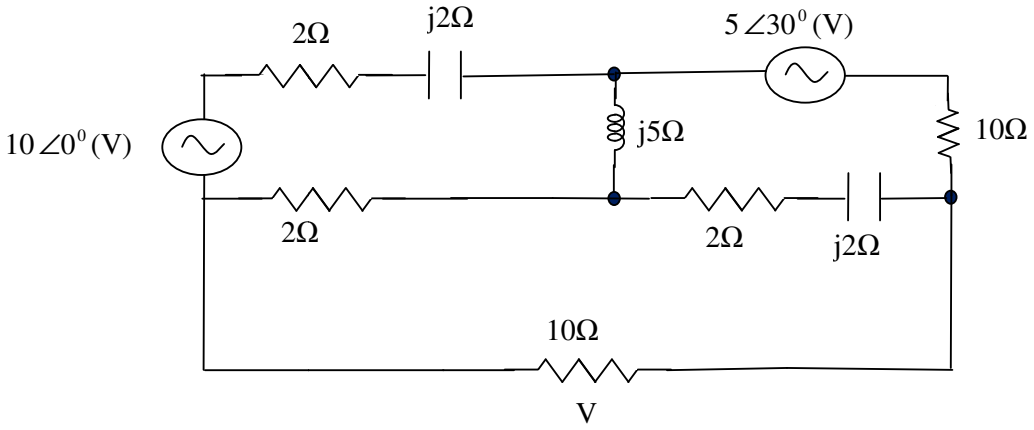

Figure 2(b)

3. a) From figure 3(a), make the graph and find one tree. How many mesh currents are required for solving the network? Find the number of possible trees. (9M)

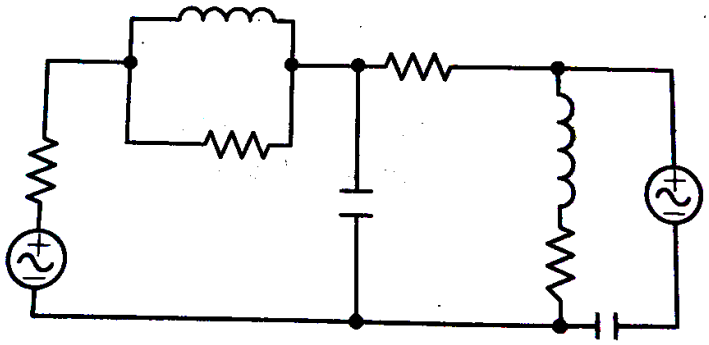

Figure 3(a)

b) Determine the basic cut set matrix for the oriented graph given as shown figure 3(b) where in the elements 1, 2, 3 are tree branches. (5M)

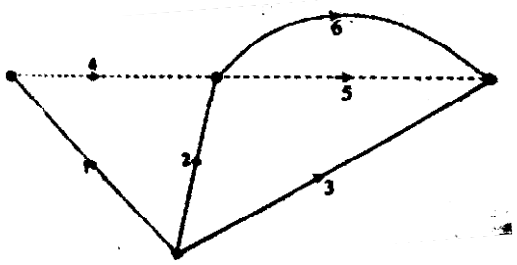

Figure 3(b)

4. a) A rectangular core has a cross-sectional area of 20 cm^2. It is made from two materials: cast steel 50 cm and steel 40 cm long. It is desired to create a flux of 3 mWb in the core. The relative permeability for cast steel is 500 and that of sheet steel is 2000. The coil has 300 turns. Find mmf and current in the coil. (7M)

b) Write down the voltage equation for the following figure 4(b), and determine the effective inductance. (7M)

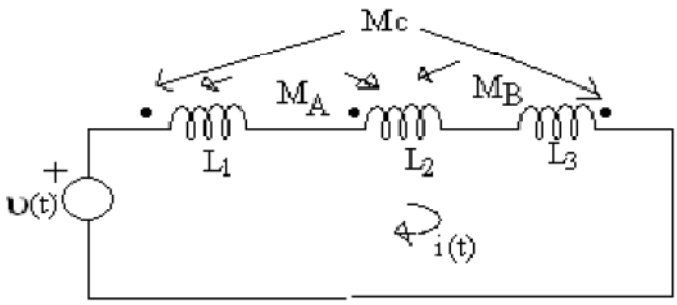

Figure 4(b)

5. a) The following circuit shown in figure 5(a) is a parallel RL arrangement connected across 200V, 50Hz ac supply calculate. (7M)
   (i) The current drawn from supply
   (ii) Apparent power
   (iii) Real power, and
   (iv) Reactive power

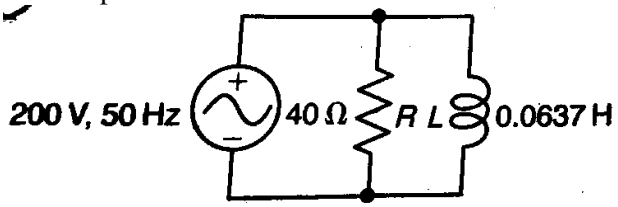

Figure 5(a)

b) Determine the rms value of a saw tooth wave as shown in figure 5(b). (7M)

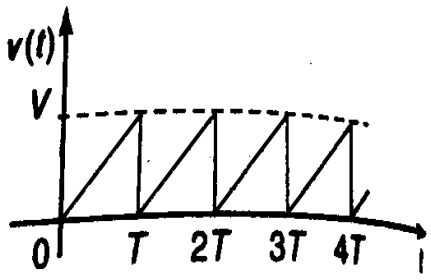

Figure 5(b)

6. a) A series RLC circuit consists of resistance R = 20 Ω, inductance, L= 0.01H and capacitance, C= 0.04μF. 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? . (7M)

b) For the series circuit shown in figure 6(b), evaluate the value of reactance when the power factor is 0.866 lag using locus diagram. (7M)

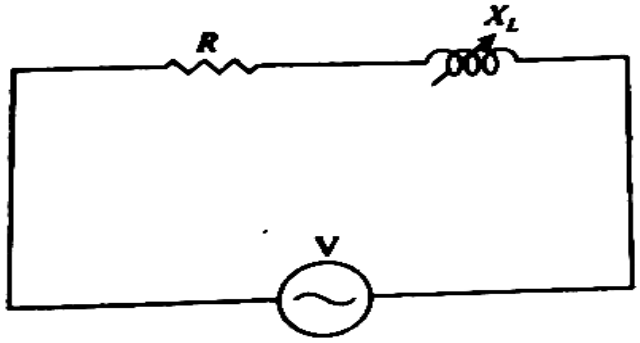

Figure 6(b)

7. a) Find the current flowing in the resistor R_4 of the network shown in figure 7(a). If a resistance of 0.5 Ω is inserted in series with R_4, find, using the compensation theorem, the current that will flow through R_4. (7M)

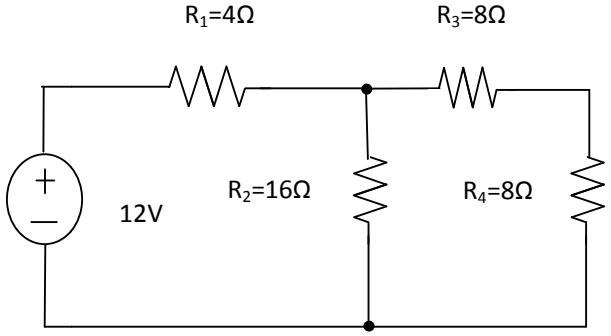

Figure 7(a)

b) Calculate the voltage V across the resistor R by using the superposition theorem as shown in figure 7(b). (7M)

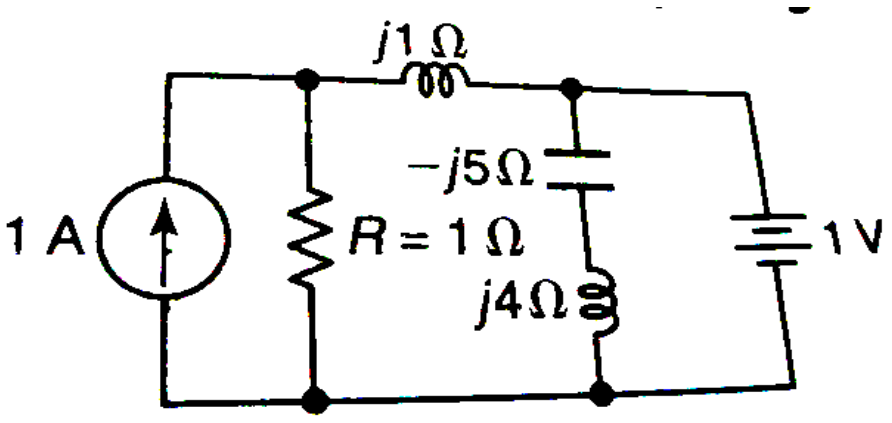

Figure 7(b).

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PART –A

1. a) Distinguish between independent and dependent sources. (3M)

b) Draw the dual of the network shown in figure 1(b). (3M)

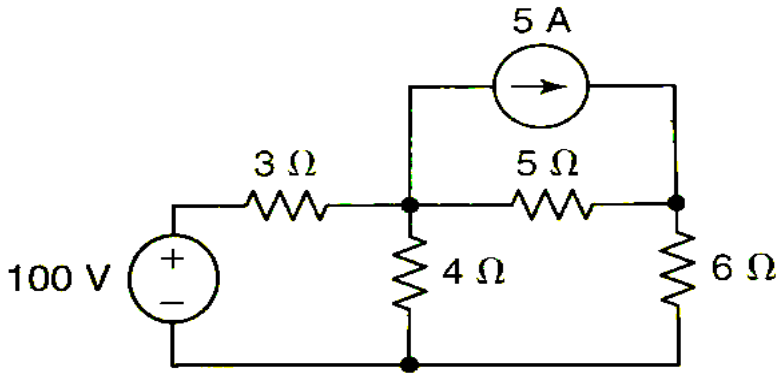

Figure 1(b)

c) Explain the dot convention used in magnetically coupled circuits. (2M)

d) Find the response "I" of an RL series circuit if R = 2Ω, L = 1H and the input voltage, v(t) = 10 sin 3t. (2M)

e) Bring out the differences between series and parallel resonance. (2M)

f) Obtain the Norton's equivalent circuit with respect to the terminals AB for the network shown in figure 1(f). (2M)

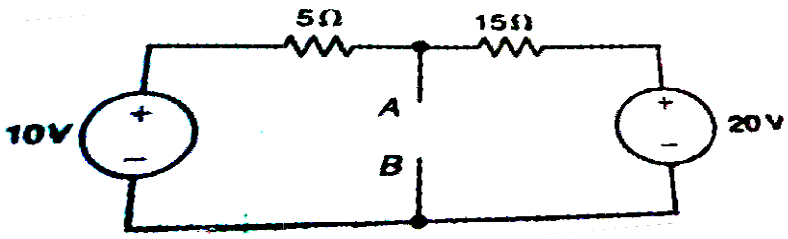

Figure 1(f)
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PART –B

2. a) Determine the current through 10-Ω resistance in the network shown in figure 2(a) by using star-delta conversion. (7M)

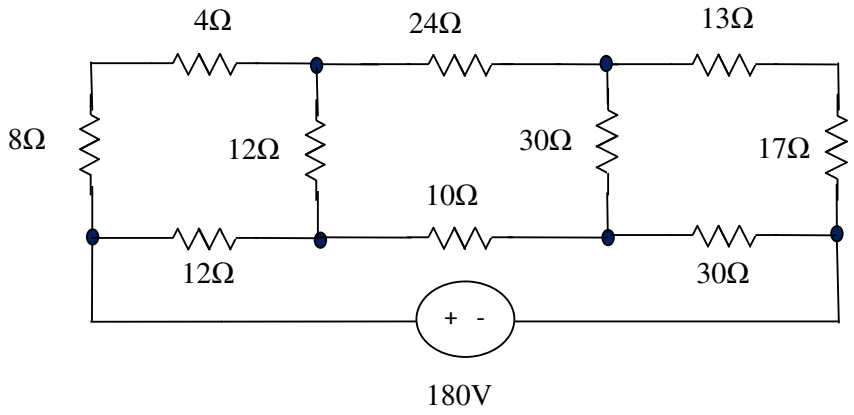

Figure 2(a)

b) Write the mesh equation for the circuit shown in figure 2(b) and determine the currents I_1, I_2 and I_3. (7M)

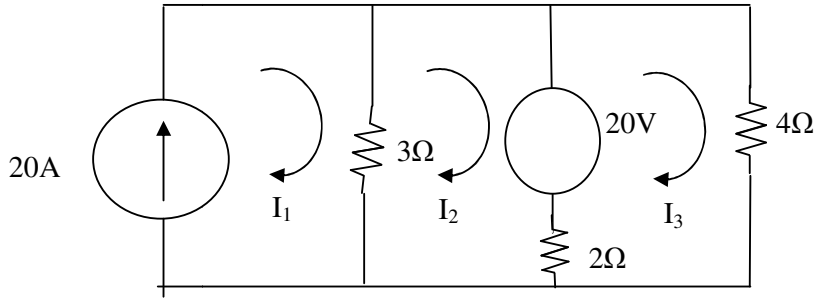

Figure 2(b)

3. a) For the graph shown in figure 3(a) select a tree, identify the tie-sets and write the tie-set matrix. (7M)

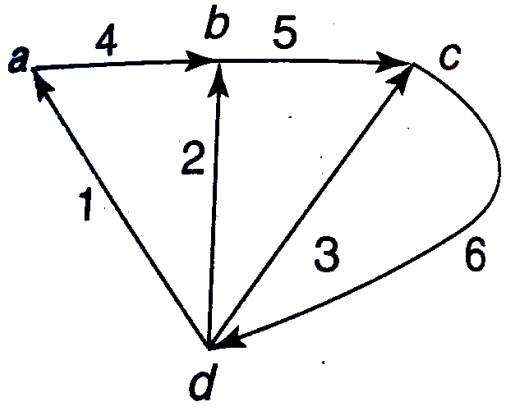

Figure 3(a)

b) Draw the graph of the network shown in figure 3(b) and write the incidence matrix. (7M)

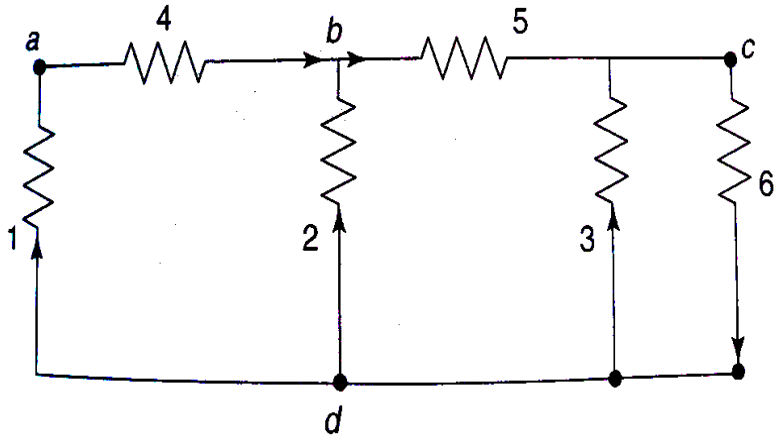

Figure 3(b)

4. a) A rectangular core has a cross-sectional area of 20 cm^2. It is made from two materials: cast steel 50 cm and steel 40 cm long. It is desired to create a flux of 3 m wb in the core. The relative permeability for cast steel is 500 and that of sheet steel is 2000. The coil has 300 turns. Find mmf and current in the coil. (7M)

b) Find the effective value of the inductance for the following connection shown in figure 4(b). (7M)

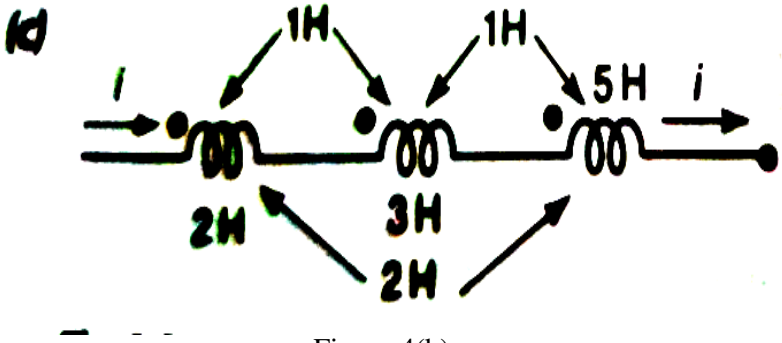

Figure 4(b)

5. a) Calculate the average and rms value for a half-wave rectified sinusoidal quantity as shown in figure 5(a). (7M)

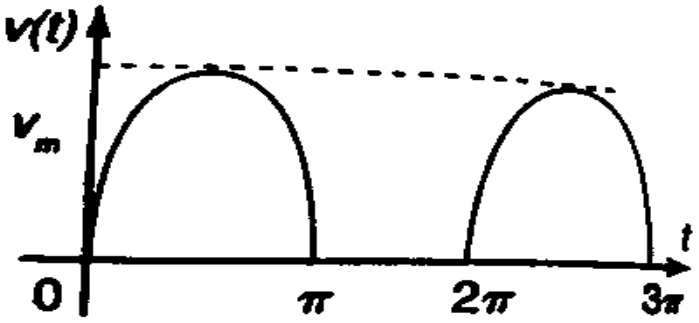

Figure 5(a)

b) Determine the total current supplied by the mains for the network shown in figure 5(b). (7M)

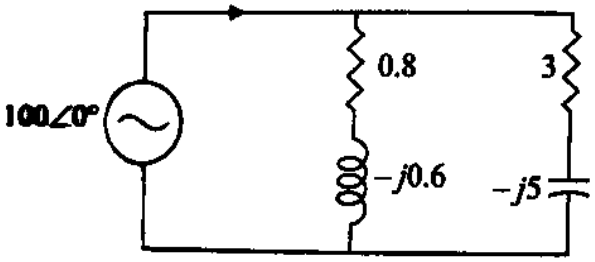

Figure 5(b)

6. a) A series RLC circuit is connected to a constant voltage variable frequency source of 200 V (rms). The values of R, L and C are 5 Ω. 0.1 H and 100 μF. What would be the voltage across C at resonance? (7M)

b) For the following circuit shown in figure 6(b), find the node voltages V_A and V_B using node voltage method. The source current is given as $I_s(t) = 10 \cos \omega t$(A), ω = 100 rad/s. (7M)

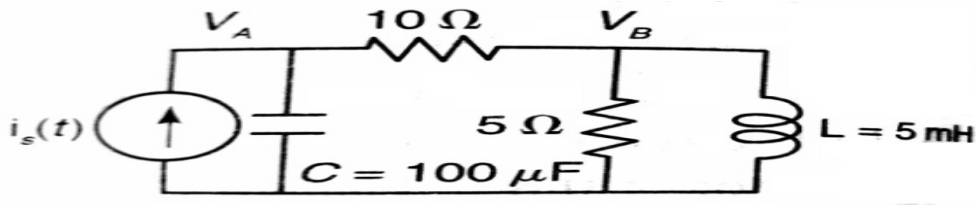

Figure 6(b)

7. a) Find the value of R in the circuit shown in below figure 7(a) such that maximum power transfer takes place. What is the amount of this power? (7M)

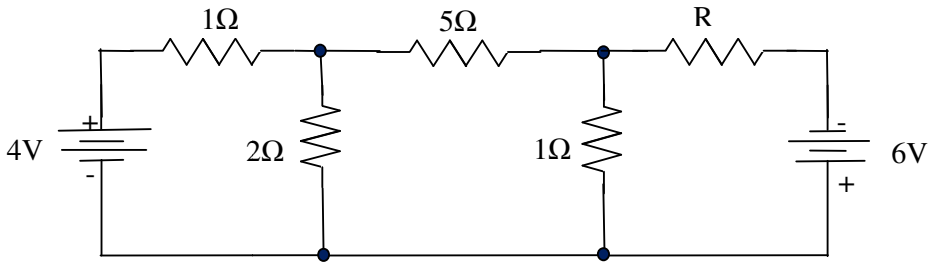

Figure 7(a).

b) Find Thevenin's equivalent about AB for the circuit shown in figure 7(b). (7M)

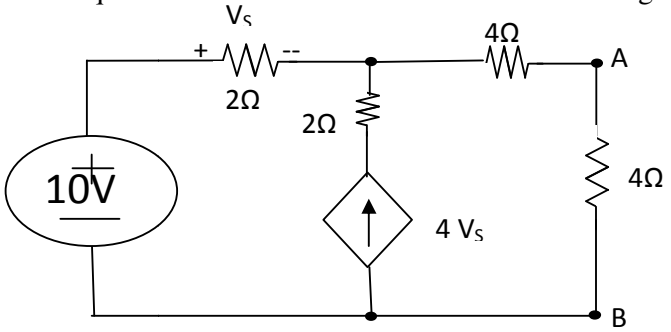

Figure 7(b).

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3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Explain the volt ampere relationships for R,L and C parameters. (2M)

   b) Determine the basic cut set matrix for the oriented graph given figure 1(b) where in the elements 1,2,3 are tree branches. (3M)

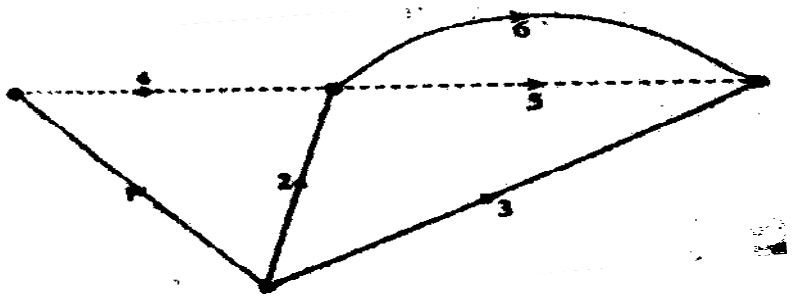

Figure 1(b)

   c) Explain the dot connection used in magnetically coupled circuits (mutual inductances) with the help of suitable examples. (2M)

   d) Explain the concept of phase angle and phase difference. (3M)

   e) Two coils of impedance $25.23 \angle 37^0$ and $18.65 \angle 68^0$ ohms are connected in series across a 230V, 50Hz supply. Find the total impedance. (2M)

   f) State Thevenin's theorem. (2M)

PART –B

2. a) Use nodal analysis to find the voltages V_A, V_B, and V_C for the circuit shown in figure 2(a), in which $I_1 = 0.4A$. (7 M)

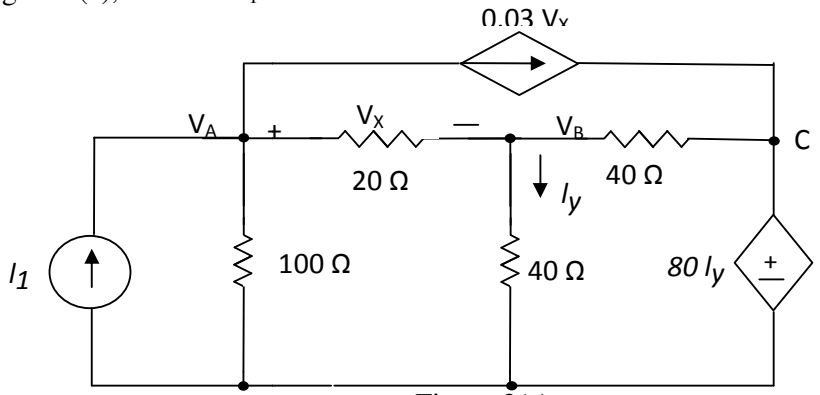

Figure 2(a)

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b) Determine the current through 10-Ω resistance in the network shown in figure 2(b) by using star-delta conversion. (7M)

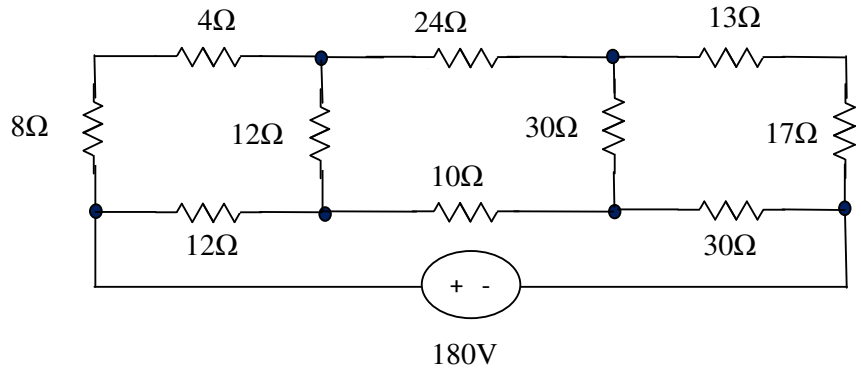

Figure 2(b)

3. a) For the network shown in figure 3(a) draw the graph and show some possible trees. (7M)

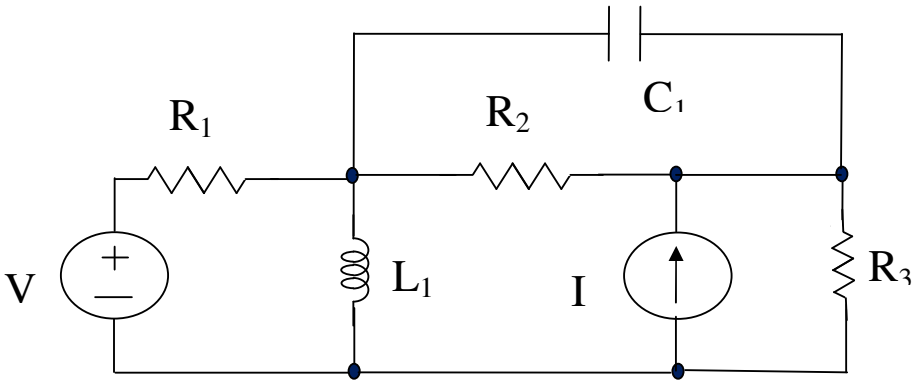

Figure 3(a)

b) Obtain the fundamental cut set matrix by choosing a suitable T (1,6,7) of the given graph shown in figure 3(b). (7M)

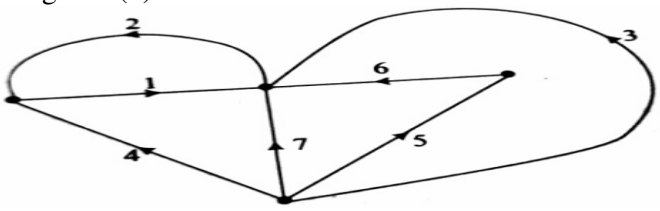

Figure 3(b)

4. a) A coil of 500 turns is wound uniformly over a wooden ring having a mean circumference of 50 cm and a cross sectional area of 500 mm^2. If the current through the coil is 3 A, calculate (7M)
   (i) The magnetic field strength
   (ii) The flux density and
   (iii) The total flux

b) Determine the coupling coefficient and the energy stored in the coupled circuits at t=1.5 s as shown in figure 4(b). (7M)

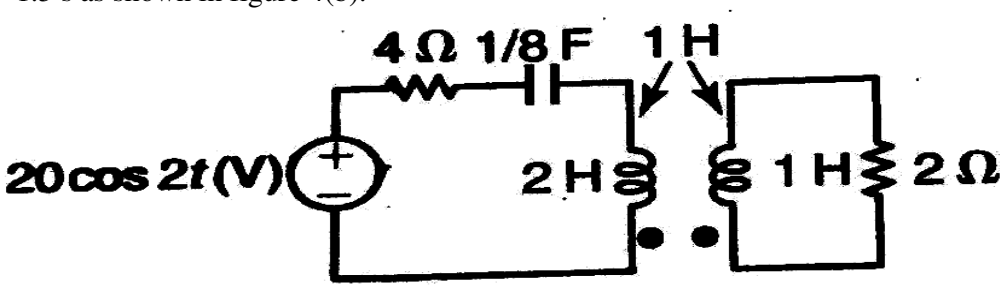

Figure 4(b)

5. a) Find the voltage V_x if, V_1 (t) = 20cos 1000t volts and V_2 (t) = 20sin 1000t volts as shown in figure 5(a). (7M)

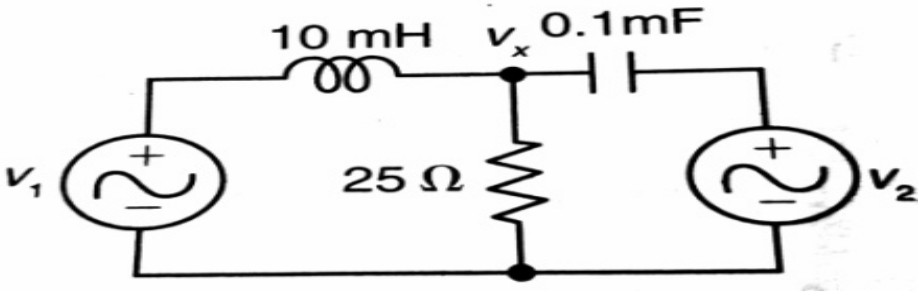

Figure 5(a)

b) Calculate the average power absorbed by the resistor and inductor. Find the average power supplied by the voltage source for the circuit shown in figure 5(b). (7M)

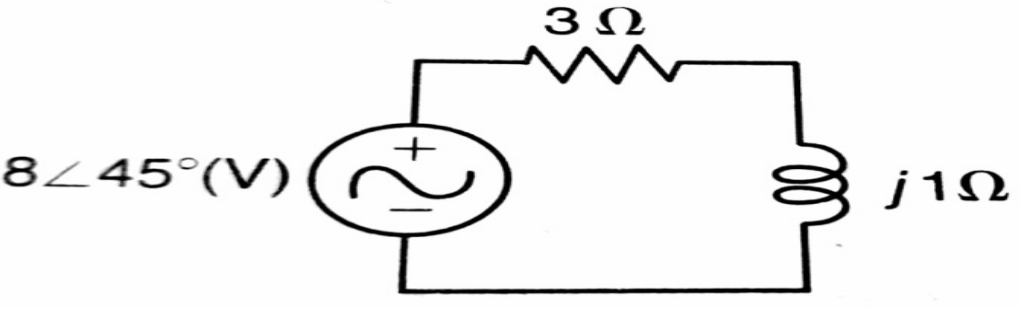

Figure 5(b)

6. a) In a series resonant network R = 6 ohm. The resonant frequency 0.5 MHz and the band width is 105 rad/sec. Compute L and C of the network. (7M)

b) A coil of 10 ohms resistance and 0.1 H inductance is connected in series with a 150 μ F capacitor and the combination is energized with 240 V, 50 Hz supply as shown in figure 6(b). Calculate (7M)
(i) The current drawn from the mainstream
(ii) The voltage across the inductor coil and
(iii) The average power consumed and the power factor of the circuit

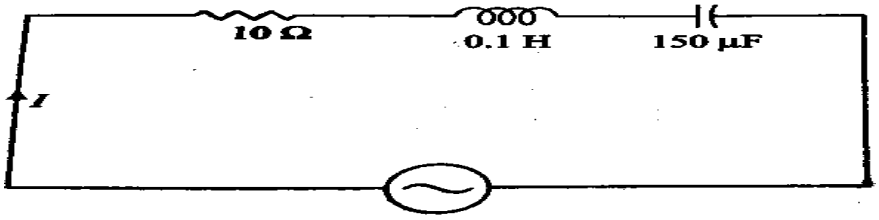

Figure 6(b)

7. a) In this circuit shown in figure 7(a), find voltage V, interchange the current source and resulting voltage V and show that the reciprocity theorem is verified. (7M)

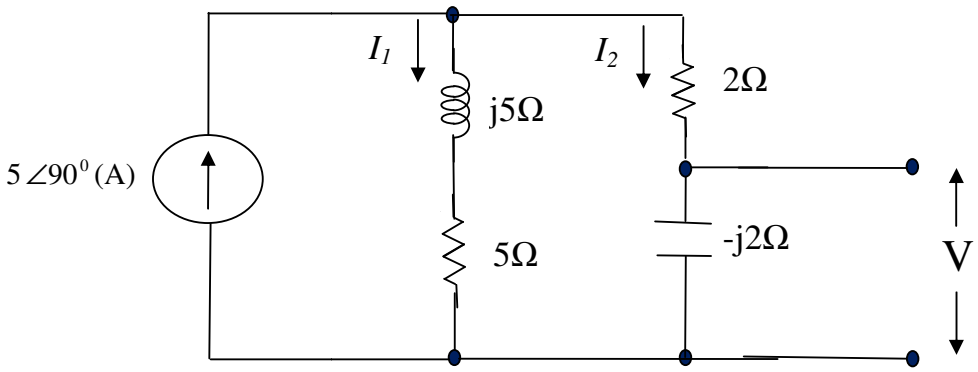

Figure 7(a)

b) Find the current I in the circuit shown in figure 7(b) using the superposition theorem. (7M)

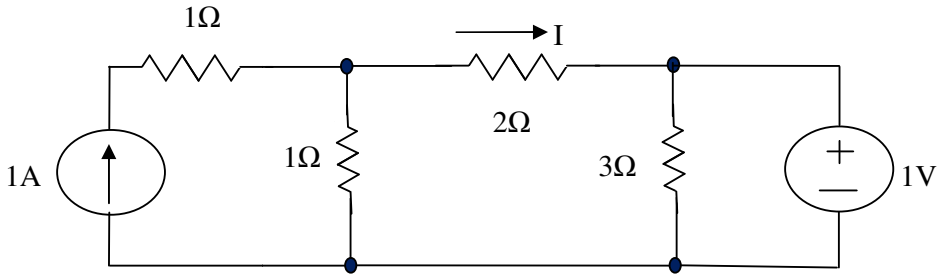

Figure 7(b)