

I B.Tech Supplementary Examinations, Aug/Sep 2008

NETWORK THEORY

(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Computer Science & Systems Engineering, Electronics & Telematics, Electronics & Computer Engineering and Instrumentation & Control Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) State and explain KCL and KVL
- (b) Distinguish between
 - i. independent and dependent sources
 - ii. Ideal and practical sources.
- (c) Find V_s if $r_1 = 2 \Omega$ $r_2 = 1 \Omega$ $r_3 = 5 \Omega$ the following figure 1c. [2+2+2+2+8]

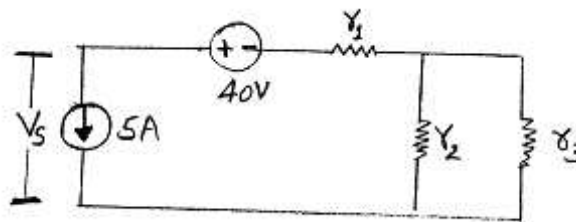


Figure 1c

2. (a) Define the following terms
 - i. Magneto motive force
 - ii. Reluctance
 - iii. magnetic field intensity
 - iv. permeability of a magnetic circuit.
- (b) An iron ring of mean diameter 20cm and a cross sectional area of 10sqcm is wound uniformly with 1000 turns of wire. If a current of 0.5A is passed through the coil, calculate the flux density in the ring assuming permeability of iron to be 800.
- (c) Explain the need for dot convention in coupled coils. With a neat diagram explain how dots are placed on coils on the same magnetic material. [4+6+6]
3. (a) Define RMS value, average value, form factor and peak factor.
- (b) Find the RMS value of the wave form the following figure3b.

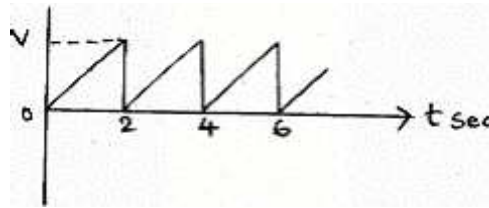


Figure 3b

- (c) Find Z , given $V = 50\angle 30^\circ$ Volts $I = 30\angle 60^\circ$ Amps the following figure 3c.

[4+6+6]

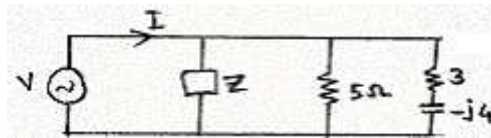


Figure 3c

4. (a) For a series RL circuit obtain the locus of current as inductance is changed from 0 to ∞ when the applied voltage is constant
 (b) Show that for a series resonant circuit $f_1 f_2 = f_r^2$ where f_1 and f_2 are half power frequencies and f_r is the resonance frequency.
 (c) Obtain the z-parameters of the following figure 4c Two port network. [6+4+6]

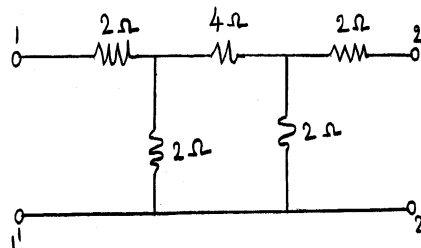


Figure 4c

5. (a) Derive the relationship between line and phase quantities in a balanced star connected system.
 (b) A 3phase 4-wire CBA system of phase sequence, with effective line voltage of 100v has a star-connected impedances given by
 $Z_A = 3.0\angle 0^\circ \Omega$ $Z_B = 4.5\angle 56.31^\circ \Omega$ $Z_C = 2.24\angle -26.57^\circ \Omega$
 Obtain the line currents and current in neutral wire. Draw the phasor diagram. [6+10]
6. (a) What is duality? Explain the procedure for obtaining the dual of the given planar network shown in the Figure 6a.

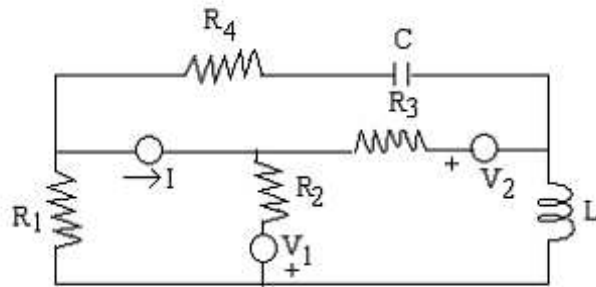


Figure 6a

- (b) Construct the incidence matrix for the graph shown in Figure 6b.

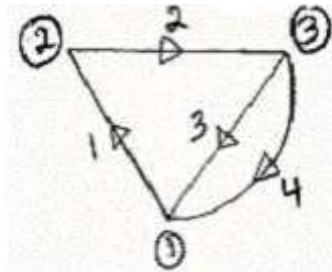


Figure 6b

- (c) Use nodal analysis, to determine the voltages V_1 and V_2 in the circuit shown the Figure 6c. [4+4+8]

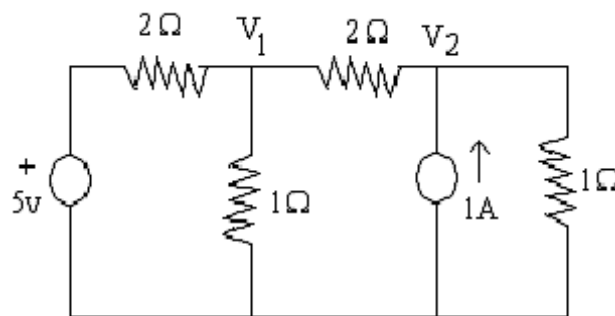


Figure 6c

7. (a) State and explain Millmann's theorem.
 (b) Using Millman's theorem find the Neutral shift voltage V_{on} the following network shown in figure7b. [6+10]

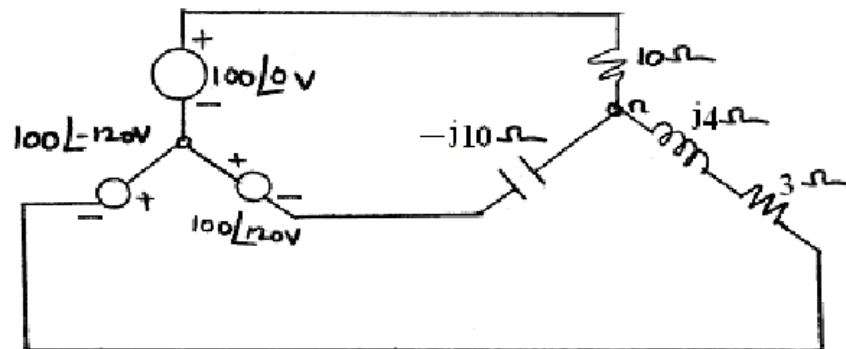


Figure 7b

8. (a) Derive the expression for $i(t)$ of a R-L series circuit when D.C voltage is applied to it at $t = 0$ by closing the switch. Define the time constant of R - L circuit. [16]
- (b) Using classical method find $i(t)$ for $t \geq 0$., for the network shown in figure8b.

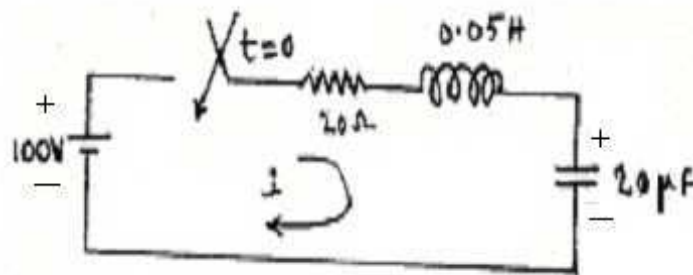


Figure 8b

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1. (a) Find the power supplied by the battery in the network shown in figure1a.

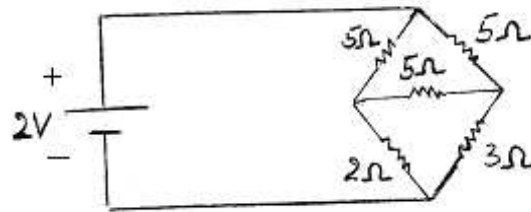


Figure 1a

- (b) Obtain the equivalent inductance at terminals "1 - 2" for the circuit shown in figure1b. [8+8]

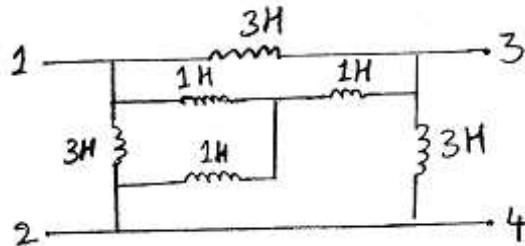


Figure 1b

2. (a) Derive the relation ship between the self inductances L_1 and L_2 and the mutual inductances M of two coupled coils.
(b) Explain what do you understand by "Leakage factor" and its effect in a magnetic circuit.
(c) A cast steel electro magnet has an air gap length of 2mm and a magnetic path of length 50cms. Find the MMF required to produce a flux density of 0.8T. In the air gap. The relative permeability of the material is 800. Neglect leakage, find MMF required. [6+4+6]
3. (a) Explain how a sinusoidal quantity can be represented by a phasor.
(b) Find the form factor of the following (figure3b). [4+12]

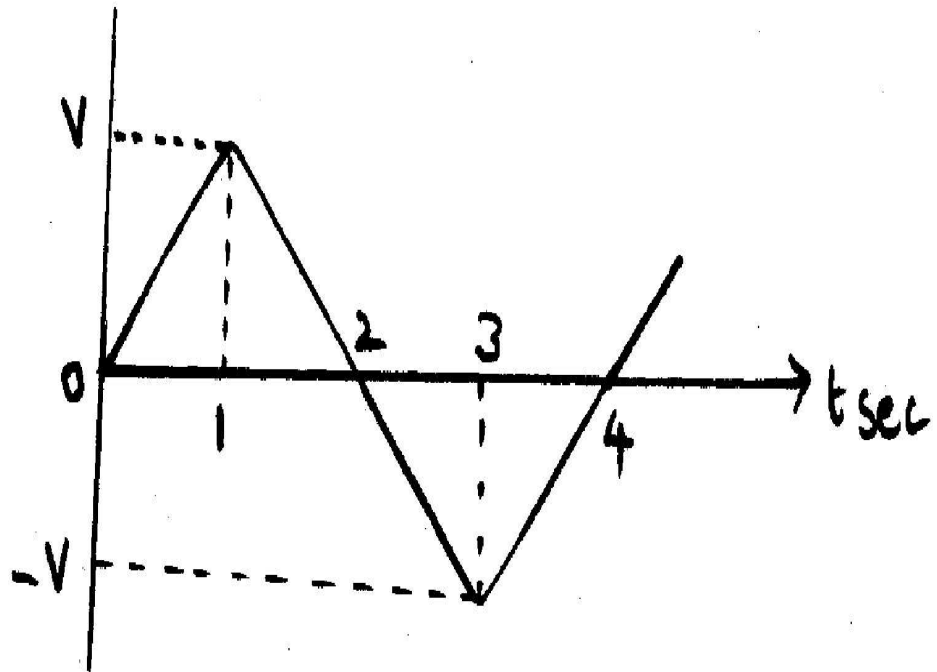


Figure 3b

4. (a) For a series RL circuit obtain the locus of current as inductance is changed from 0 to ∞ when the applied voltage is constant
- (b) Show that for a series resonant circuit $f_1 f_2 = f_r^2$ where f_1 and f_2 are half power frequencies and f_r is the resonance frequency.
- (c) Obtain the z-parameters of the following figure 4c Two port network. [6+4+6]

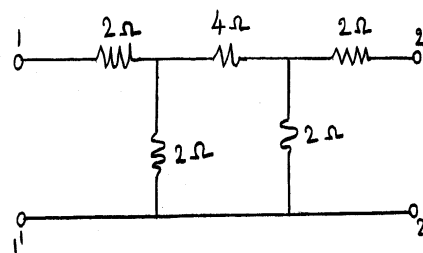


Figure 4c

5. (a) A 3 phase 3 wire balanced supply is connected to an unbalanced 3 wire star

connected load. Derive an expression for the neutral displacement voltage between supply and load neutral points.

- (b) A 3phase, 3 wire 208 volts BYR system has a star connected load with $Z_R = 6\angle 0^\circ \Omega$, $Z_Y = 6\angle 30^\circ$ and $Z_B = 5\angle 45^\circ$. Obtain the line currents and load voltages of the circuit using the neutral displacement method. Draw the phasor diagram. [6+10]

6. (a) Define the following:

- Oriented graph
- Tree of a graph
- Cut set and a Basic Cut set and
- Tieset & Basic Tieset.

- (b) For the topological graph shown in the figure6b, obtain the fundamental Tieset matrix choosing the tree containing two elements 5 & 6.

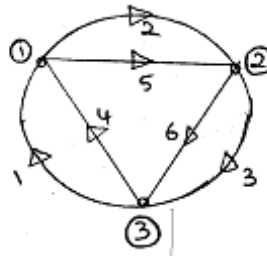


Figure 6b

- (c) Derive expression for elements of m-derived low pass T filter in terms of proto type T network. [4+4+8]

7. (a) State and explain the superposition theorem.

- (b) Using super position theorem find the current in 2 ohms resistor from the following network shown in figure7b. [6+10]

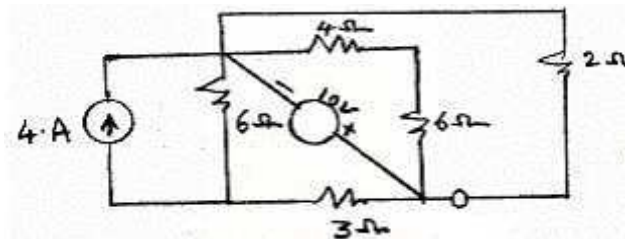


Figure 7b

8. Draw the network in Laplace domain and find $I(s)$ shown in figure8 Switch is opened at $t = 0$. [16]

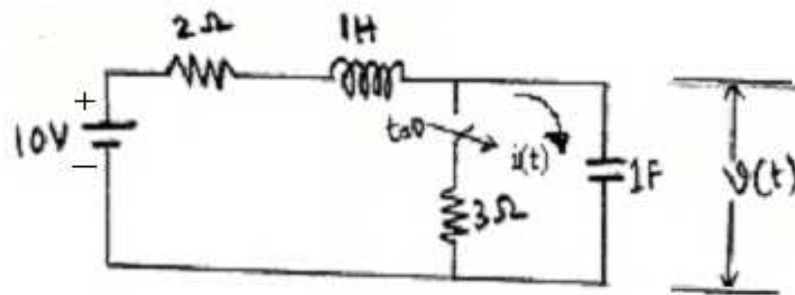


Figure 8

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1. (a) Distinguish between dependent sources and independent sources. Give some examples.
- (b) Find V_1 in figure1b.

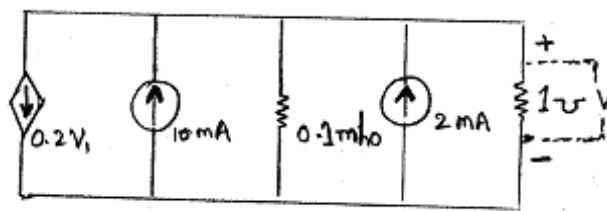


Figure 1b

- (c) Find V_x , r_2 , and r_3 in the figure1c.

[4+6+6]

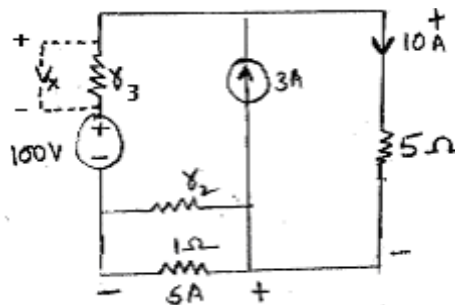


Figure 1c

2. (a) Find the current I in the following magnetic circuit As shown in Figure 2a to produce a flux density of 1.6 T in the air gap. All dimensions are in mm. The core has a uniform square cross section. Assume $\mu_r = 600$.

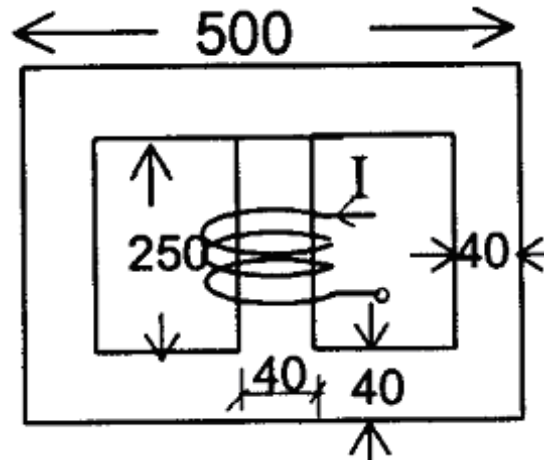


Figure 2a

- (b) Place the dots for the coils at the appropriate terminals for the following coupled coils
{As shown in the Figure2b}

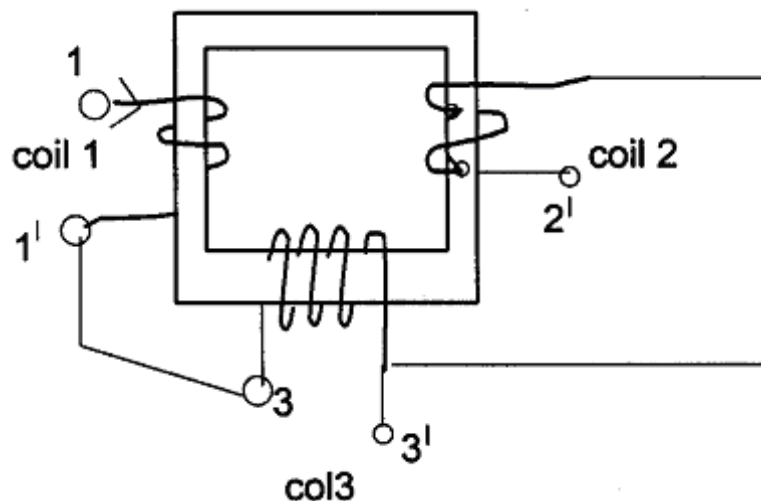


Figure 2b

If a voltage of $v(t)$ is applied across the terminals 1 and 2'. Write the differential equation relating the voltage and current. Neglect resistances of the coils.
[10+6]

3. (a) Define RMS value, average value, form factor and peak factor.
(b) Find the RMS value of the wave form the following figure3b.

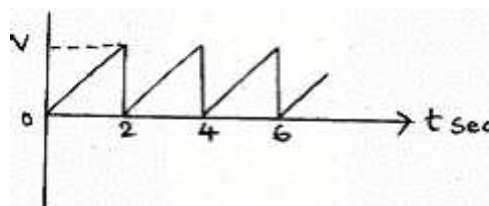


Figure 3b

- (c) Find Z , given $V = 50\angle 30^\circ$ Volts $I = 30\angle 60^\circ$ Amps the following figure3c.

[4+6+6]

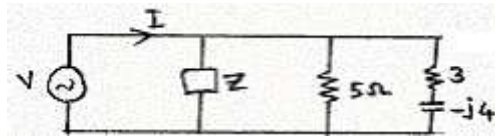


Figure 3c

4. (a) In the circuit shown in the figure 4a $y_{11} = y_{22} = 2S$; $y_{12} = y_{21} = -1S$ for the network N. If $R_1 = 2\Omega$ find the value of R_L for maximum power transfer.

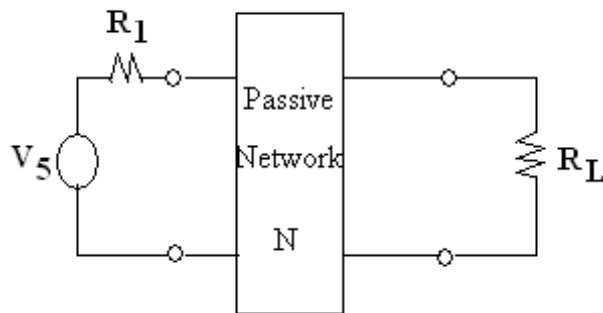


Figure 4a

- (b) Obtain the expression for resonance frequency of a parallel resonant circuit shown in the figure 4b. [6+10]

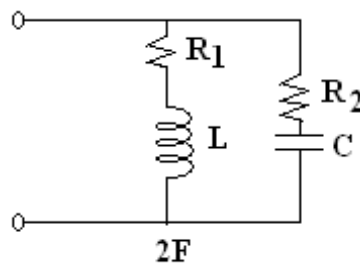


Figure 4b

Find the condition for resonance at all frequencies.

5. (a) Derive the expressions for two wattmeter readings used to measure power in balanced 3 phase loads.
- (b) A balanced, 3 phase, load is supplied from a symmetrical 3 phase, 400v, systems. The current in each phase is 30A and lags by 30° behind the phase voltage. Find the impedance and total active and reactive power if the load is star connected. [8+8]
6. (a) What is duality? Explain the procedure for obtaining the dual of the given planar network shown in the Figure 6a.

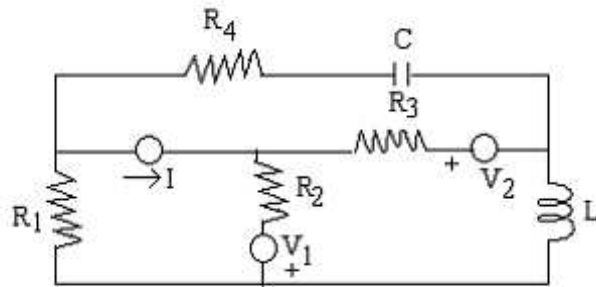


Figure 6a

- (b) Construct the incidence matrix for the graph shown in Figure 6b.

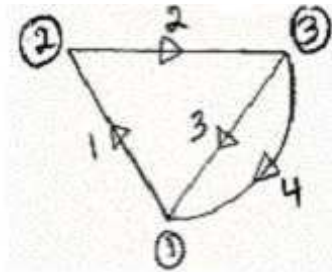


Figure 6b

- (c) Use nodal analysis, to determine the voltages V_1 and V_2 in the circuit shown the Figure 6c. [4+4+8]

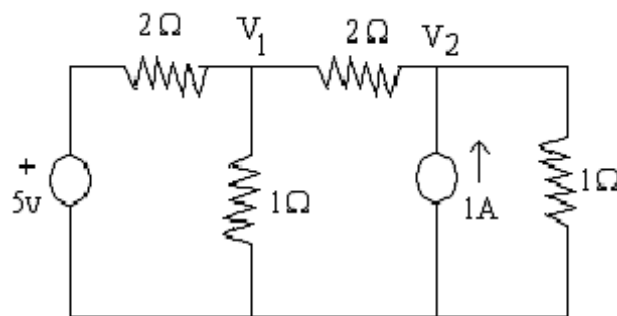


Figure 6c

7. (a) State and explain the superposition theorem.
 (b) Using super position theorem find the current in 2 ohms resistor from the following network shown in figure7b. [6+10]

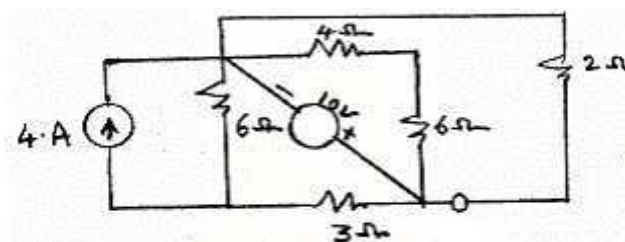


Figure 7b

8. (a) Derive the expression for $i(t)$ and voltage across capacitance $V_c(t)$ for series R

- C circuit with D.C. voltage applied to it at $t = 0$. Explain about the time constant of RC circuit.
- (b) Switch S is moved from position 1 to 2 at $t = 0$ find the voltages $V_R(t)$ and $V_c(t)$ for $t \geq 0$ the following figure8b. [8+8]

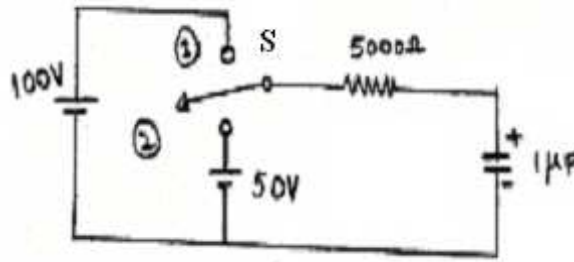


Figure 8b

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Time: 3 hours

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Answer any FIVE Questions
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1. (a) Explain how source transformation is achieved.
- (b) A current of 0.5A is supplied by a source to an inductor of 1H. Calculate the energy stored in the inductor. What happens to this energy if the source is short-circuited?
- (c) A current source $i = I_m \sin \omega t$ is applied across.
 - i. a 1F capacitor
 - ii. 1H inductor.

Assuming initial conditions to be zero, show the voltage waveforms in the above two cases. [16]

2. (a) State and explain Faraday's laws of electromagnetic induction.
- (b) A magnetic circuit consists of an circular ring of mean diameter 15 cm with a single narrow saw-cut through the ring. The width of the saw-cut is 0.1cm. and the material of the ring has a magnetization curve given by the following table

H(AT/m) :	40	80	120	160	800	1600	3200
B(wb/m ²) :	0.37	0.72	0.92	1.04	1.4	1.47	1.55

A coil of 400 turns is uniformly wound on the ring. Estimate the current in the coil required to cause a flux of 0.28 mwb in the air gap formed by the saw-cut. Area of the air-gap is 4 cm². [4+12]

3. (a) Explain how a sinusoidal quantity can be represented by a phasor.
- (b) Find the form factor of the following (figure3b). [4+12]

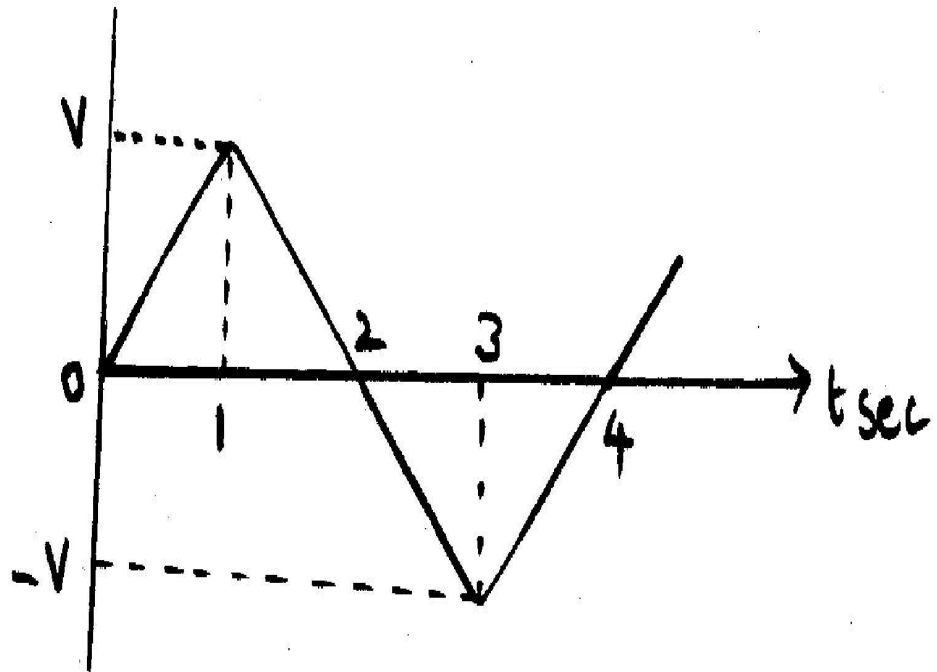


Figure 3b

4. (a) For a series RL circuit obtain the locus of current as inductance is changed from 0 to ∞ when the applied voltage is constant
- (b) Show that for a series resonant circuit $f_1 f_2 = f_r^2$ where f_1 and f_2 are half power frequencies and f_r is the resonance frequency.
- (c) Obtain the z-parameters of the following figure 4c Two port network. [6+4+6]

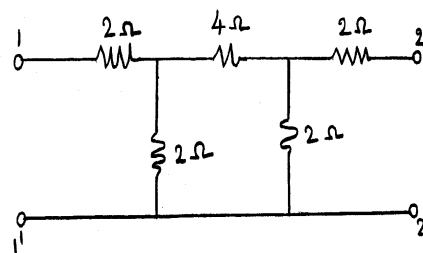


Figure 4c

5. (a) Each phase of a balanced star connected load consists of $R=10$ ohms and

$C=10\mu\text{F}$. Calculate the line current, and total real and reactive powers when a symmetrical 400V, 50Hz, 3 phase supply is applied to it. If two watt meters are employed to measure total power, what will be the readings of the two wattmeters.

- (b) A 400v, 50HZ, 3phase supply of phase sequence ABC is applied to a delta connected load consisting of 100Ω resistance between lines A&B , 318 mH inductance between lines B & C and $31.8\mu\text{F}$ capacitance between lines C & A. Determine the phase and line currents. [8+8]
6. (a) Explain how you make a choice between loop and node methods of analysis for any network.
- (b) In the network shown in Figure 6b, determine the value of source voltage V which results in dissipation of 100 watts in 5Ω resistor.

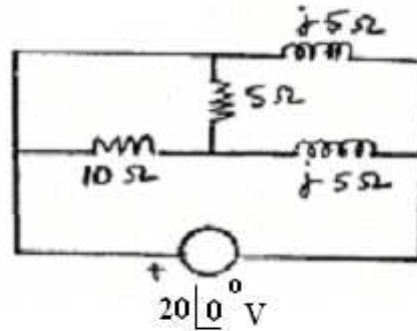


Figure 6b

- (c) Draw the dual of the circuit shown in the Figure 6c. [4+8+4]

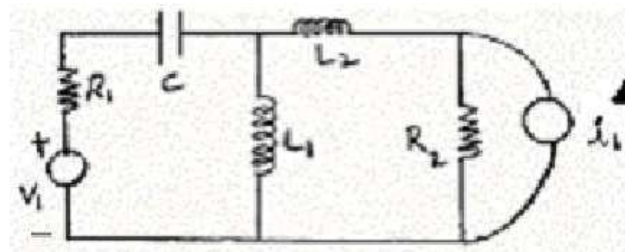


Figure 6c

7. (a) State and explain the superposition theorem.
- (b) Using super position theorem find the current in 2 ohms resistor from the following network shown in figure7b. [6+10]

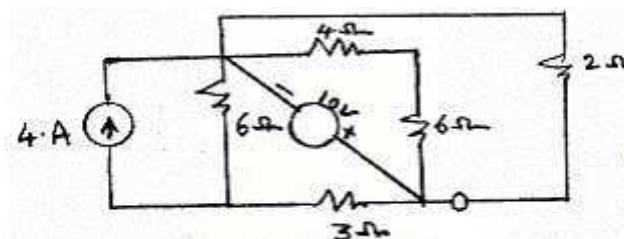


Figure 7b

8. (a) Derive the expression for $i(t)$ of a R-L series circuit when D.C voltage is applied to it at $t = 0$ by closing the switch. Define the time constant of R - L circuit. [16]
- (b) Using classical method find $i(t)$ for $t \geq 0$., for the network shown in figure8b.

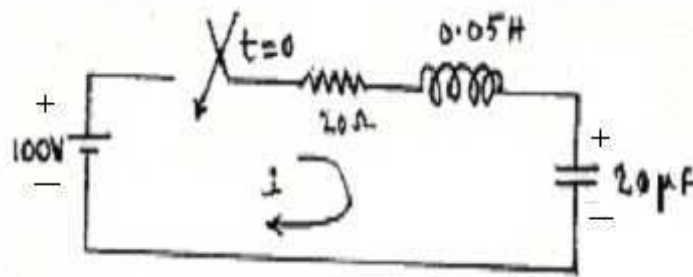


Figure 8b
