

B. POWER ENGINEERING EXAMINATION -2023
 (2nd Year – 1st Semester)
 SUBJECT – Circuit Theory

Time: Three hours

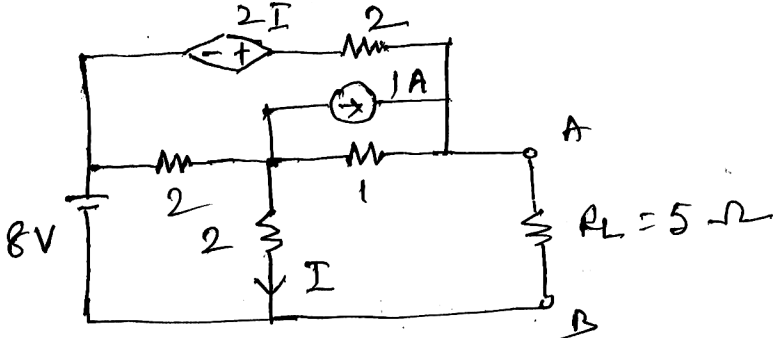
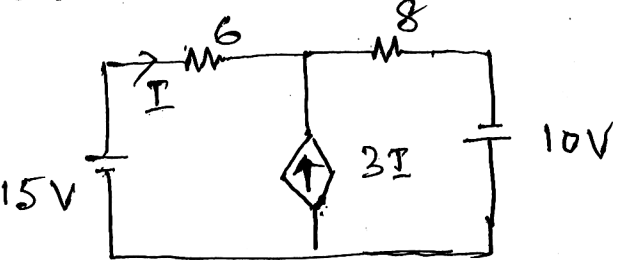
Full Marks: 100

Answer any *seven* questions as directed under each group

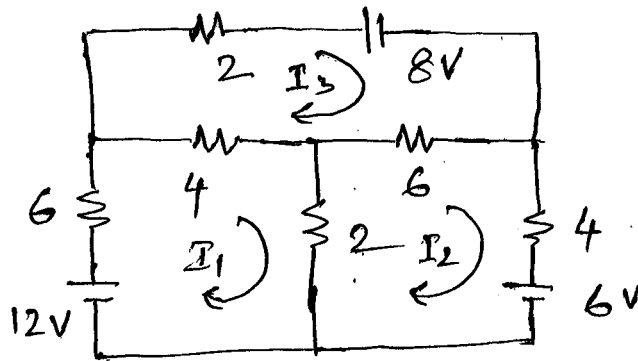
Assume suitable value for missing data, if any

All the values of resistors are in Ω .

All parts of a question to be answered at one place.

No. of Question		Marks
Group A Answer any <i>two</i> questions		
1.(a)	State and explain Thevenin's Theorem with suitable example.	4
(b)	Determine the current flowing through the load resistance using Thevenin' Theorem for the network shown below. Find also the maximum power dissipated.	10
		
2. (a)	State and explain Superposition Theorem.	4
(b)	Determine the current flowing through the 6Ω resistor using Superposition Theorem.	10
		

<p>3. (a)</p>	<p>The loop equations of a network are given by</p> $8I_1 - 5I_2 - I_3 = 110, \quad -5I_1 + 12I_2 = 0, \quad -I_1 + 7I_3 = 115$ <p>Draw the network. Find the current supplied by each source.</p>	<p>7</p>
<p>(b)</p>	<p>Determine the current through 5Ω resistor for the network shown below by loop analysis.</p>	<p>7</p>
<p>Group B</p>		
<p>Answer <i>any one</i> question</p>		
<p>4. (a)</p>	<p>Define and explain the following with suitable examples:</p> <ul style="list-style-type: none"> (i) Cut set and fundamental cut set matrix (ii) Tree and rank of a graph (iii) Isomorphic graphs 	<p>3+2+2</p>
<p>(b)</p>	<p>Draw the directed graph for the network shown below. Select a particular tree of your choice and write down the fundamental cut set matrix for the same.</p>	<p>7</p>
<p>5.</p>	<p>For the network as shown below, draw the directed graph and write down the fundamental tie set matrix for a particular tree of your choice. Use it to determine loop currents I_1, I_2 and I_3.</p>	<p>14</p>



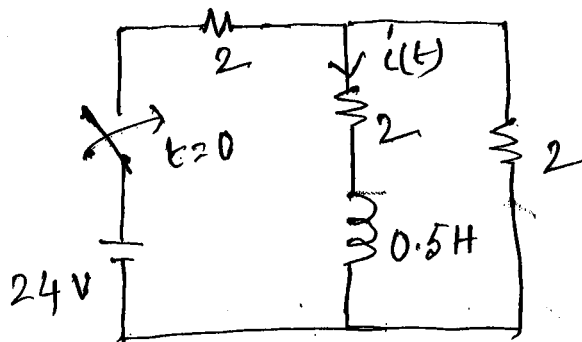
Group C
Answer any two question

6. (a) State and explain Final value Theorem with suitable example

4

(b) Using Final value Theorem, find the steady state value of the current through the inductor for the circuit shown below. The switch is closed at $t = 0$.

10

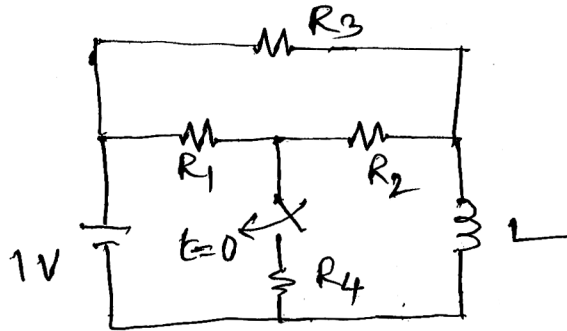


7. A pulse of width b (starting from origin) and magnitude 10 V is applied at time t to a series RC circuit with $R = 1\Omega$ and $C = 0.25\text{ F}$. Find the current flowing through circuit assuming zero net charge across the capacitor.

14

8. The circuit shown below is at steady state with the switch open. The switch is closed at $t = 0$. Obtain the current through the inductor for $t > 0$. Assume $R_1 = R_2 = R_4 = 1\Omega$, $R_3 = 2\Omega$ and $L = 1\text{ H}$

14



Group D

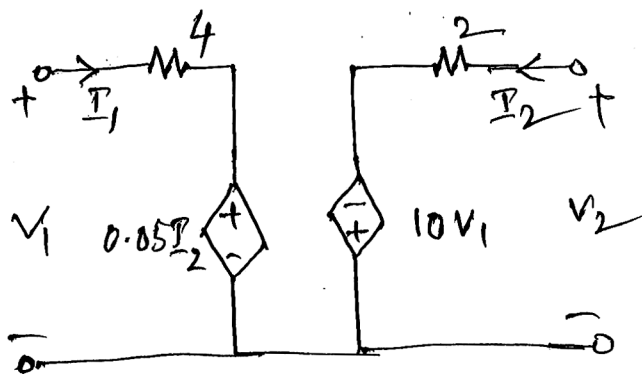
Answer *any one* question

- (9) Discuss the half wave symmetry of periodic function with suitable example. Hence show that Fourier Series of periodic functions having half wave symmetry contains only odd harmonics. 14
10. An rms current of 5A which has a third harmonic component is passed through a coil having $R=1.0\ \Omega$, $L=10\ mH$. The rms voltage across the coil is 20 V. Calculate the magnitude of the fundamental and harmonic components of the current if fundamental frequency is $300/2\pi$ Hz. Find also the power dissipated. 14

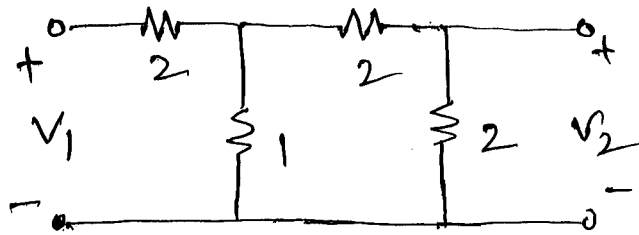
Group E

Answer *any one* question

11. Determine the Z-parameters and Y-parameters for the network shown below. 14



12. Two identical sections of the network as shown below are connected in cascade. 14



Obtain the transmission (ABCD) parameters of the overall network.