

**B.E.E 2ND YEAR 1<sup>ST</sup> SEM. SUPPLE EXAM.-2017**

**SUBJECT: - Circuit Theory**

**Time: Three hours**

**Full Marks 100  
(50 marks for each part)**

**Use a separate Answer-Script for each part**

No. of Questions	PART-I	Marks
Answer any three, 2 marks for well organized answers		
1.	<div data-bbox="383 492 1244 907" data-label="Diagram"> <p>The circuit diagram for Fig. 1(a) consists of a 5V DC voltage source on the bottom wire. On the left vertical wire, there is a 5Ω resistor. The top wire contains a 1H inductor, a 10Ω resistor, and a 2A current source pointing to the left. A 2Ω resistor is connected between the node after the 10Ω resistor and the bottom wire. A 2μF capacitor is connected between the node after the 2A current source and the bottom wire. A 1A current source is connected between the node after the 2μF capacitor and the bottom wire. A 1H inductor is connected between the node after the 2A current source and the node after the 2μF capacitor. A 0.5H inductor is connected between the node after the 1H inductor on the top wire and the node after the 2A current source. A 1H inductor is connected between the node after the 0.5H inductor and the bottom wire.</p> </div> <p style="text-align: center;">Fig. 1(a)</p> <p>a) Write loop equations in matrix form for the above circuit (Fig. 1(a)).</p> <p>b) For what value of <math>k</math> the open circuit voltage of the following circuit (Fig.1(b)) is zero?</p> <div data-bbox="399 1108 1276 1444" data-label="Diagram"> <p>The circuit diagram for Fig. 1(b) shows a 4V DC voltage source on the left. A 3Ω resistor is on the top wire. A 5Ω resistor is connected between the node after the 3Ω resistor and the bottom wire. A dependent current source labeled <math>kV_x</math> is connected between the top and bottom wires. A 15Ω resistor is on the top wire to the right of the current source. The voltage across the 3Ω resistor is labeled <math>V_x</math>.</p> </div> <p style="text-align: center;">Fig. 1(b)</p>	<p style="text-align: right;">10</p> <p style="text-align: right;">6</p>
2. a)	<p>Draw the graph of the network whose loop incidence matrix is shown as:</p> $B = \begin{bmatrix} 1 & 1 & -1 & 0 & 0 & 0 \\ -1 & 0 & -1 & 1 & -1 & 0 \\ 0 & 0 & 1 & 1 & 0 & -1 \end{bmatrix}$ <p>Choose a tree of the graph including branches 1, 2, and 4 and draw the corresponding cut-set matrix.</p>	<p><b>6</b></p>

b) Find the short circuit current from terminal A to B for the Fig. 2. (b).

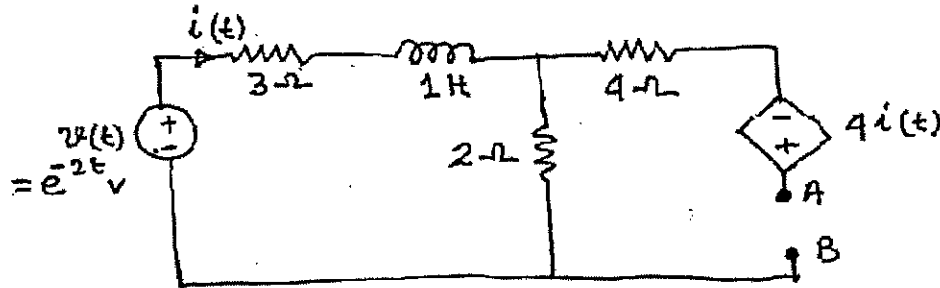


Fig. 2. (b)

10

3. a) State and explain reciprocity theorem.

6

b) Describe dot convention of coupled circuit with suitable example.

4

c) Derive network equilibrium equations on node basis using node to element incidence matrix applying Graph Theory.

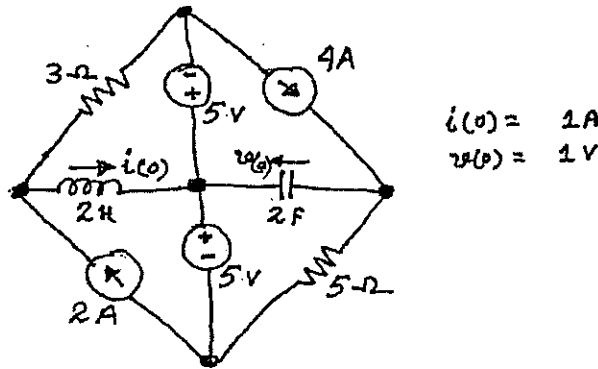
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4. a) State and explain Thevenin's theorem.

4

b) Apply nodal analysis to find current through 5 ohm resistor of the network given below.

12



$i(t) = 1A$   
 $v(t) = 1V$

Fig. 4. (b)

5. a) For the source of 25V, the current distribution in a source free resistive network (N) is shown in Fig. 5 a (i) given below. Find the value of current 'i' for the conditions shown in Fig. 5 a (ii).

8

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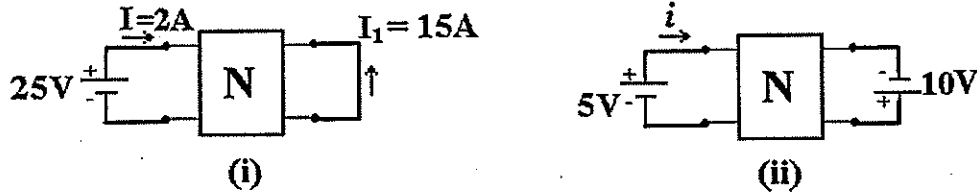


Fig. 5 (a)

- b) Find the resistance seen by the independent voltage source in the circuit of Fig. 5 (b).

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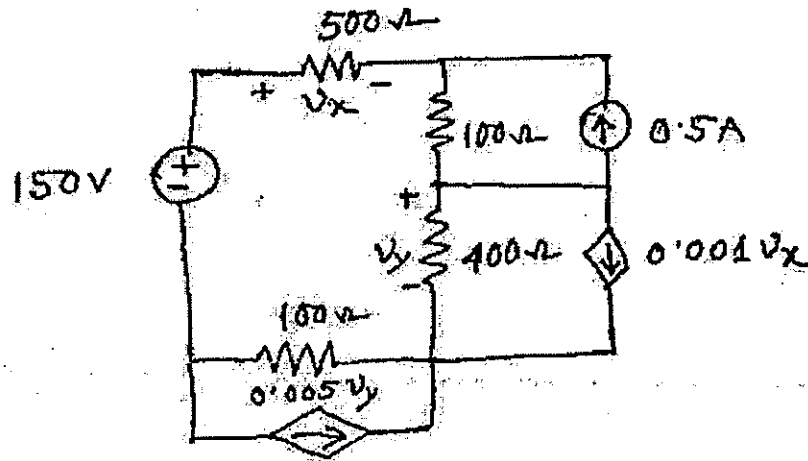


Fig. 5 (b)

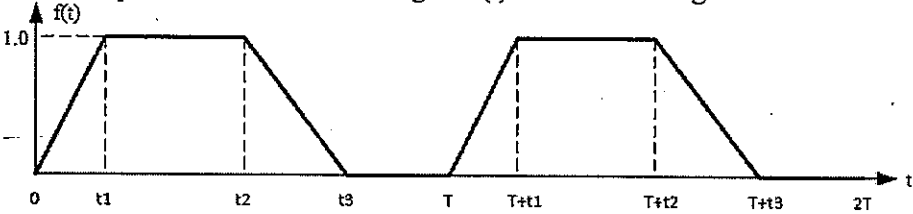
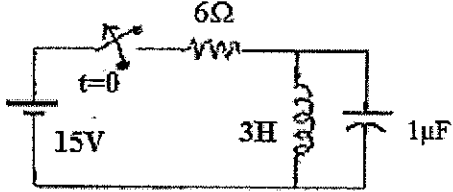
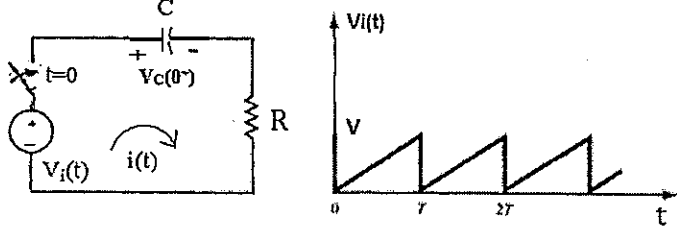
BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING EXAMINATION, 2017  
(2<sup>nd</sup> Year 1<sup>st</sup> Semester, Supplementary)

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No. of question	<p style="text-align: center;"><b>Part II</b> <b>Answer any three questions.</b> Two marks reserved for neatness and well organized answer.</p>	Marks
1.a)	<p>Derive the Laplace transform of the signal <math>f(t)</math> as shown in Fig.:-</p> 	8
b)	<p>In the circuit shown in Fig, switch is closed and steady-state condition is reached. At time <math>t = 0</math>, the switch is opened. Obtain the expression of current through the inductor.</p> 	8
2.a)	<p>Determine the voltage drop across a resistance R for a periodic input waveform <math>V_i(t)</math> as shown in Figure. The switch is closed at <math>t=0</math>. Assume <math>V_c(0^+) = v/2</math>.</p> 	10

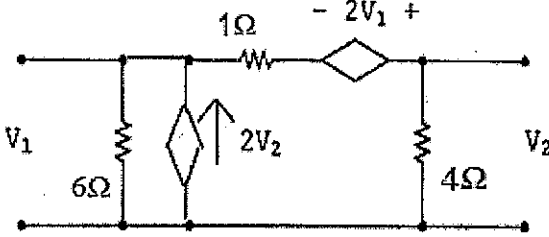
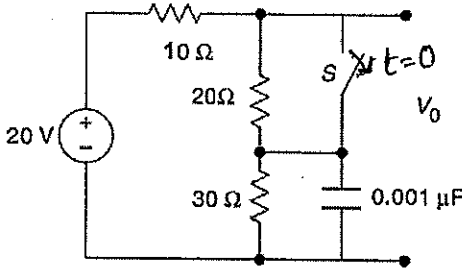
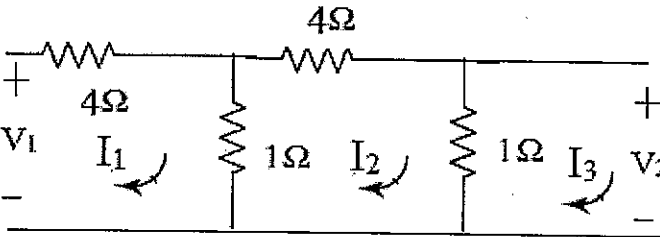
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b)	<p>Find the Z parameters of the network shown below;</p> 	6
3.a)	<p>The switch S is closed for a long time in the given network. It is opened at <math>t=0</math> and reclosed at <math>t=10\mu s</math>. Find the expression for voltage <math>V_0</math> for <math>t \leq 10\mu s</math> and <math>t &gt; 10\mu s</math>.</p> 	10
b)	<p>Write a short note on the concept of "Complex frequency".</p>	6
4.a)	<p>Determine the transmission parameters of the network. Is it a reciprocal &amp; symmetrical network?</p> 	8

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b)	Prove the condition for reciprocity and symmetry for a two-port network in terms of its short circuit admittance parameters.	8
5. a)	The open circuit impedance parameters of a certain two port network are $z_{11} = 15$ ohm, $z_{12} = 5$ ohm, $z_{21} = 6$ ohm, $z_{22} = 10$ ohm. Find the transmission parameters of the network. Derive necessary relations.	8
b)	Find the Y parameters of the network as shown in Figure:	8