Ref No:

Ex/EE/T/211/2018

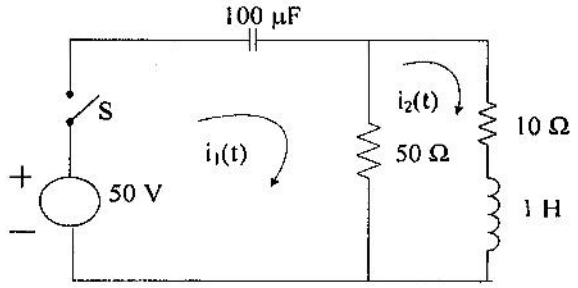
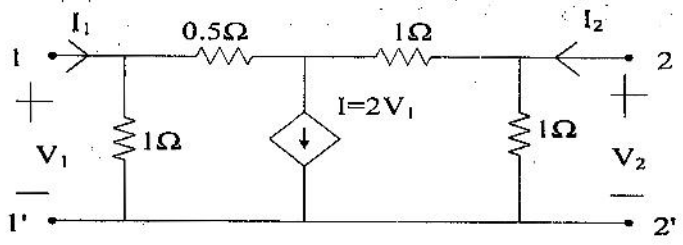
B.E ELECTRICAL ENGINEERING SECOND YEAR FIRST SEMESTER EXAM, 2018

SUBJECT: - CIRCUIT THEORY

Time: Three hours

Full Marks: 100
(50 marks for this part)

Use a separate Answer-Script for each part

No. of Question		PART -I Answer any Three All the parts of a particular question are to be answered sequentially. (Two marks reserved for well organized answers)	Marks
1)	a)	A series combination of resistance R Ω and inductance L H is switched on across a voltage E sin ωt volts. Derive the expression for the current in the circuit. Sketch the waveform of the current clearly showing its various components.	(8)
	b)	In the circuit shown in Fig.Q.1.(b), the switch is closed at t = 0. Derive the expression for the currents $i_1(t)$ and $i_2(t)$ for t > 0 .  Fig.Q.1.(b)	(8)
2)	a)	The two-port network shown in Fig.Q.2.(a) is connected at Port-1 to a 10 V d.c. source with an internal resistance of 1Ω. A resistance of 100 Ω is connected across the Port-2 of the network. Determine the power drawn from Port-2.  Fig.Q.2.(a)	(10)
	b)	Write a note on the concept of complex frequency.	(6)

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3)	a)	Derive the condition for reciprocity and symmetry when a two port network is represented by its transmission parameters.	(8)
	b)	Two identical networks shown in Fig. Q.3.(b) are in cascade. Obtain the resulting transmission parameters.	(8)

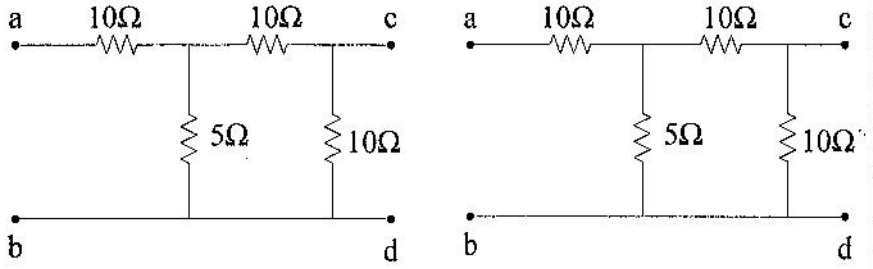

Fig.Q.3.(b)

4)	a)	Express the function in Fig.Q.4.(a) using singularity functions and then find its Laplace Transform.	(6)

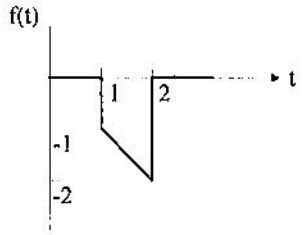

Fig.Q.4.(a)

	b)	When an impulse δ(t) V is applied to a certain network, the output voltage is $v_o(t) = 4u(t) - 4u(t-2)$ V. Find and sketch $v_0(t)$ if the applied voltage is $2u(t-1)$ V.	(6)
	c)	Explain why the current in a constant inductive system does not change instantaneously?	(4)
5)	a)	Determine the current in inductor L_2 as shown in Fig.Q.5.(a), after switch is closed at t =0. Assume that the voltage source v(t) is applied at t = -∞.	(10)

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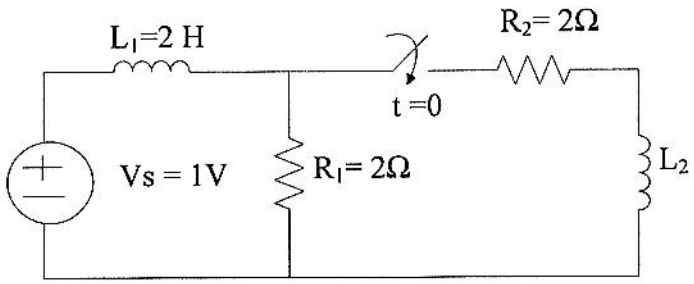

Fig.Q.5.(a)

b) Find the Laplace transform of the periodic signal x(t) shown in Fig below (6)

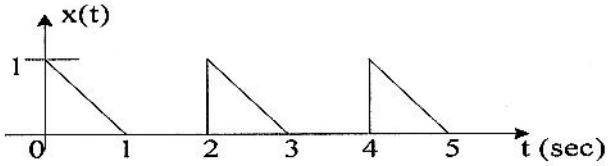

Fig Q.5.(b)

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B.E. ELECTRICAL ENGINEERING 2ND YEAR 1ST SEMESTER EXAM 2018

SUBJECT: - Circuit Theory

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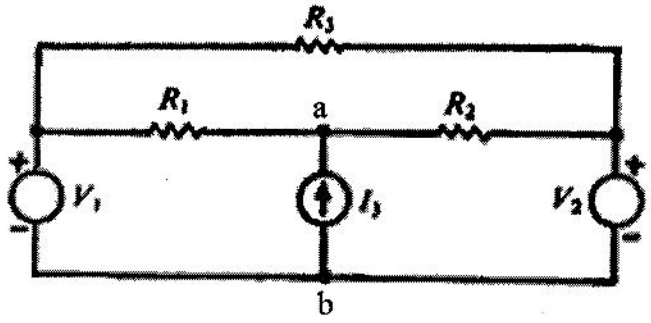
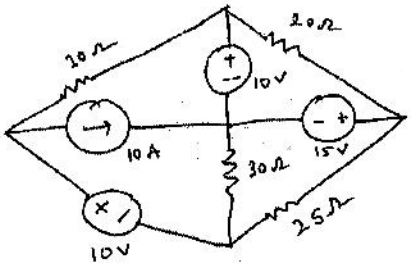
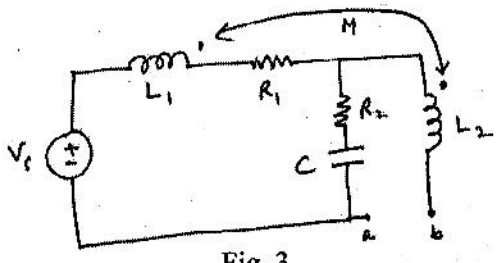
No. of Questions	PART-II	Marks
	Answer any five (5X10=50)	
1. a)	In the network given below (Fig 1 (a)), $R_1=R_2=R_3=10$ ohms, $V_1=10V$, $V_2=5$ V, $I_3=2A$. Obtain a single source equivalent across terminals 'a'-'b' using source transformation techniques.  Fig. 1	5
b)	Show that Kirchhoff's current law may be written in terms of basic cut-set matrix.	5
2. a)	Find the node voltages for the network of Fig 2.  Fig 2.	6
b)	Are Thevenin's and Norton's theorems applicable to any electrical network? Explain.	4
3.	Find the Thevenin's equivalent of the circuit given in Fig. 3 between terminals 'a'-'b'.  Fig. 3 $R_1 = R_2 = 2\Omega$ $L_1 = 2H$ $L_2 = 1H$ $M = 0.5H$ $V_s = 10V\angle 0°$ C= 1F	10

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4.	Find the short circuit current through terminals 'a'-'b' for the circuit given in Fig. 3 of Question 3.	10
5.	Form loop equations in matrix form for the network of Fig 5 using Graph theory.	10

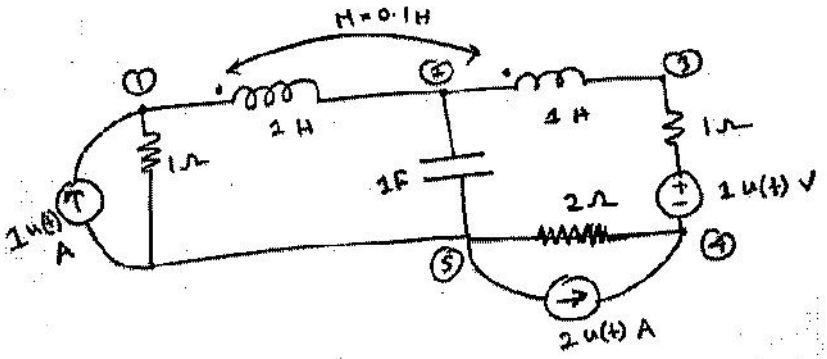

Fig. 5

6. a)	Using compensation theorem, find the change in current in each of the following branches of the network of Fig. 6(a) when the resistance of value 4Ω is decreased to 2Ω.	6

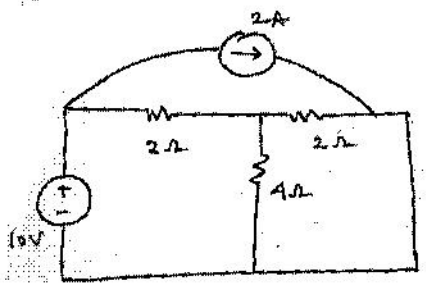

Fig. 6 (a)

b)	Put dots to indicate polarities of the 3 magnetically coupled coils shown in the Fig. 6(b) given below.	4

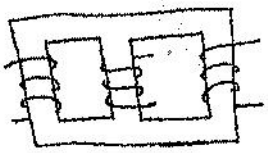

Fig. 6 (b)

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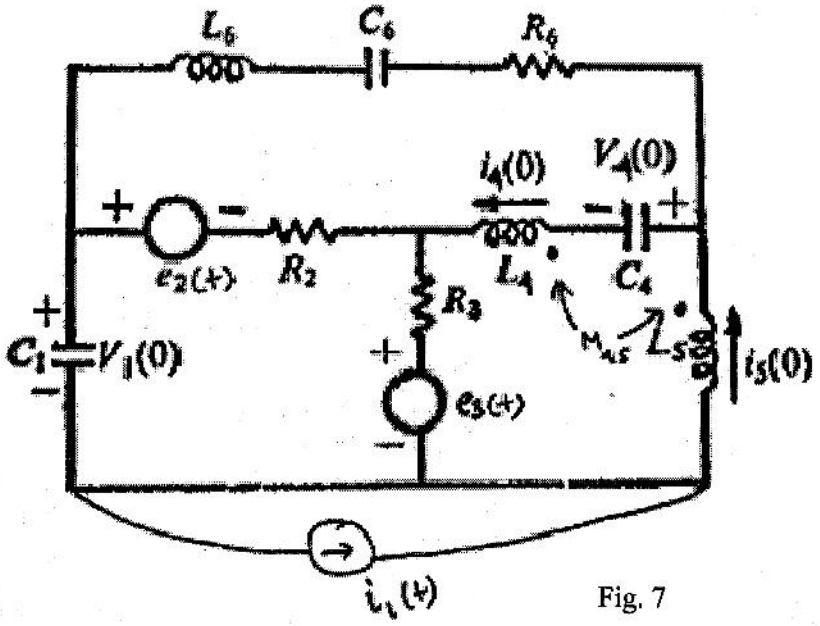
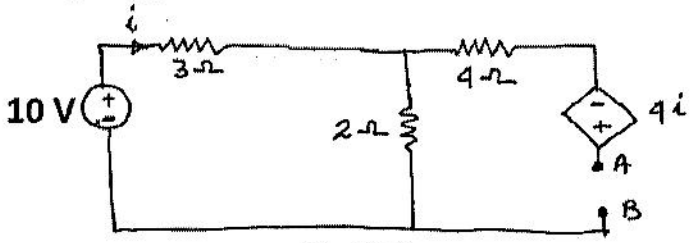
7.	Write sufficient number of linearly independent loop equations in *s*-domain for the circuit given below (Fig.7).  Fig. 7	10
8. a)	Define: *'Tree'* and *'link'* in the context of Graph of electrical networks.	4
b)	What is the Thevenin's equivalent resistance of the circuit across terminals *A* and *B* for the Fig. 8. (b).  Fig. 8 (b)	6