Ref. No.: EX/EE/PC/B/T/212/2023(S)

B.E. ELECTRICAL ENGINEERING 2ND YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION, 2023

Subject: CIRCUIT THEORY **Time: Three Hours** **Full Marks: 100**

Part I (50 marks)

Question No. | ***Question 1 is compulsory*** | Marks

Answer ***Any Two*** questions from the rest (2×20)

Q1 Answer ***Any One*** : (a) ***or*** (b)

Consider the circuit as shown in Figure Q1.

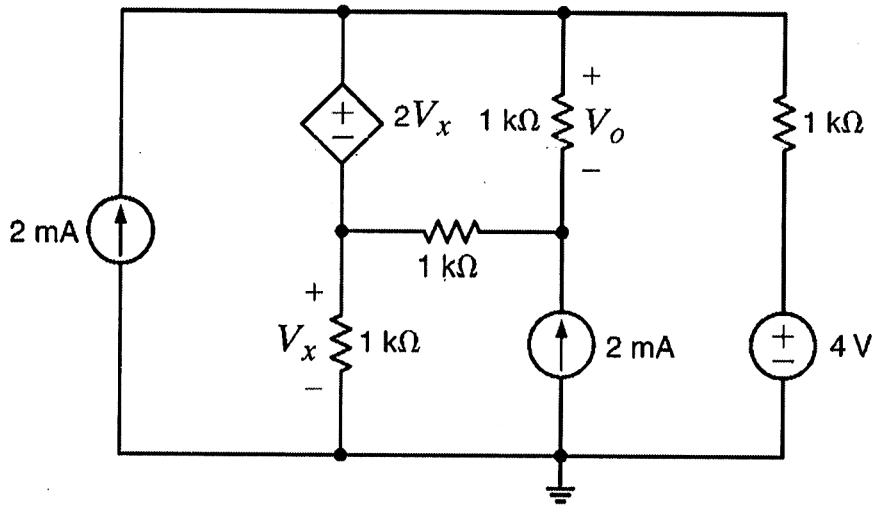

Figure Q1

(a) Determine the value of the voltage V_0 using Loop Analysis technique. 10

OR

(b) Determine the value of the voltage V_0 using Nodal Analysis technique. 10

Q2 (a) Determine the current through the 8-V battery using Mesh analysis for the circuit shown in Figure Q2(a).

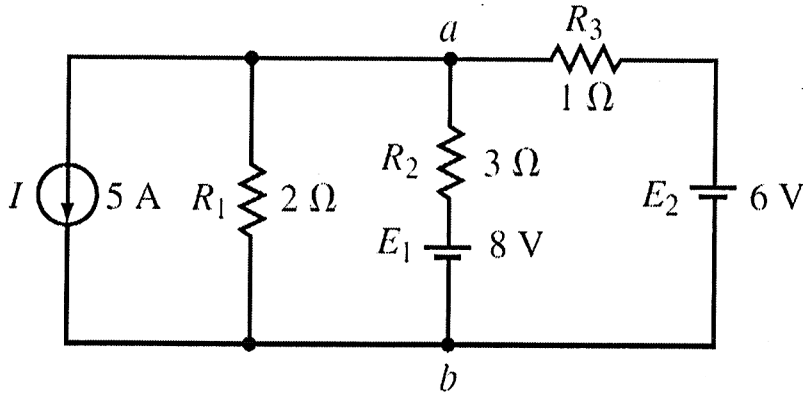

Figure Q2(a) 8

Q2 (b) Find the voltage across R_3 in the circuit shown in Figure Q2(b). 8

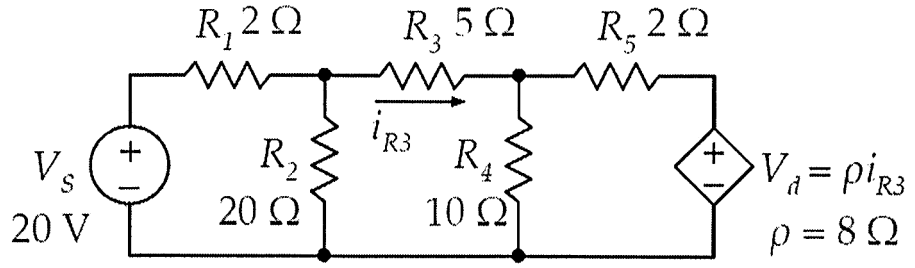

Figure Q2(b)

(c) Find the total inductance of the series coils shown in Figure Q2(c). 4

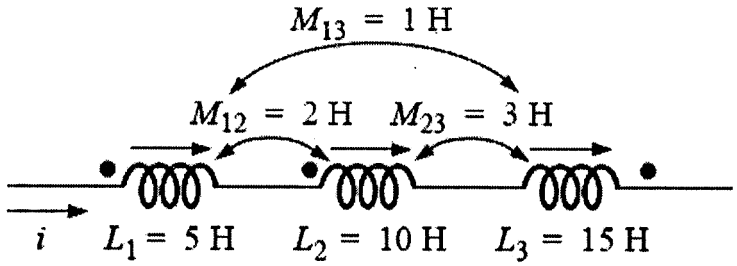

Figure Q2(c)

Q3 (a) Solve for the currents through R_2 and R_3 in the circuit of Figure Q3(a). 12

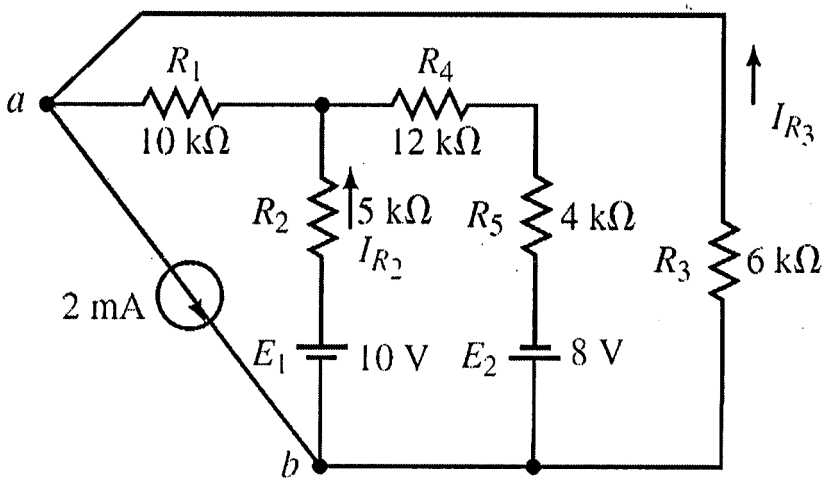

Figure Q3(a)

Q3 (b) For the circuit shown in Figure Q3(b) determine the currents I_1 and I_2. 8

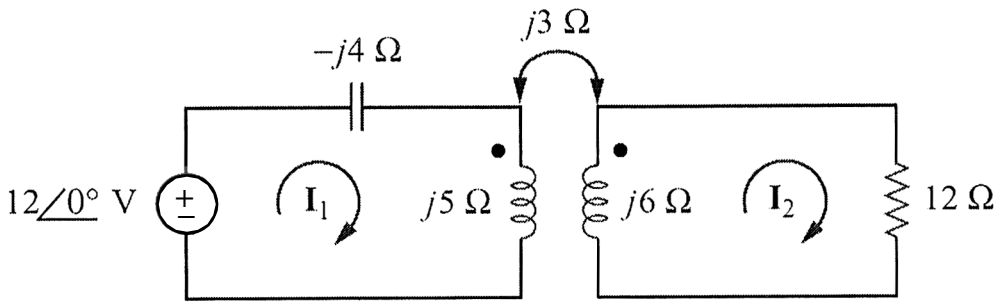

Figure Q3(b)

Q4 (a) For the circuit shown in Figure Q4(a) obtain the Thevenin equivalent circuit across the terminal A-B. 8

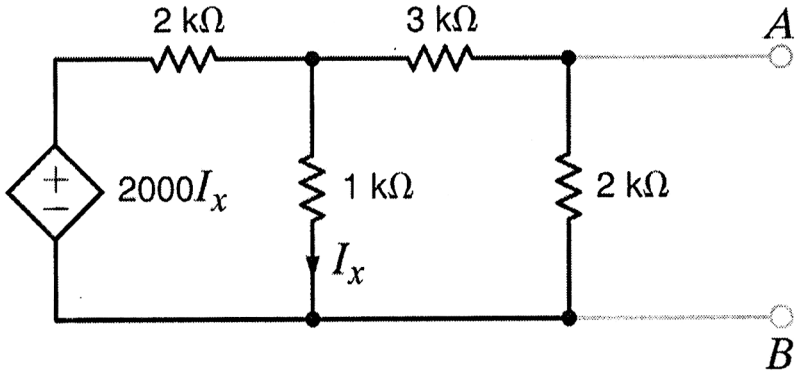

Figure Q4(a)

(b) With the help of an example define the following for a graph of a network 4

(i) Tree, (ii) Co-Tree, (iii) Twigs, (iv) Chords.

(c) For the network shown in the Figure Q4(c), obtain fundamental Cut-Set Matrix and then derive the node equations. 8

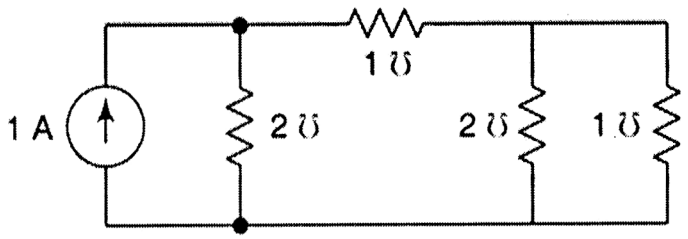

Figure Q4(c)

Q5 (a) For the oriented graph shown in Figure Q5(a), express loop currents in terms of branch currents for a tree composed of branches 5, 6, 7, 8.

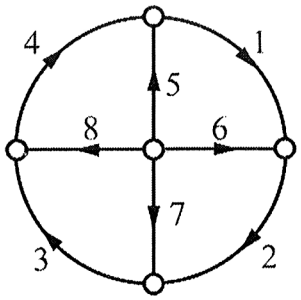

Figure Q5(a)

(b) Assume that a steady state has been reached before the switches are operated at $t = 0$, as shown in the circuit in Figure Q5(b). Using Laplace Transform technique obtain the expression for $V_0(s)$.

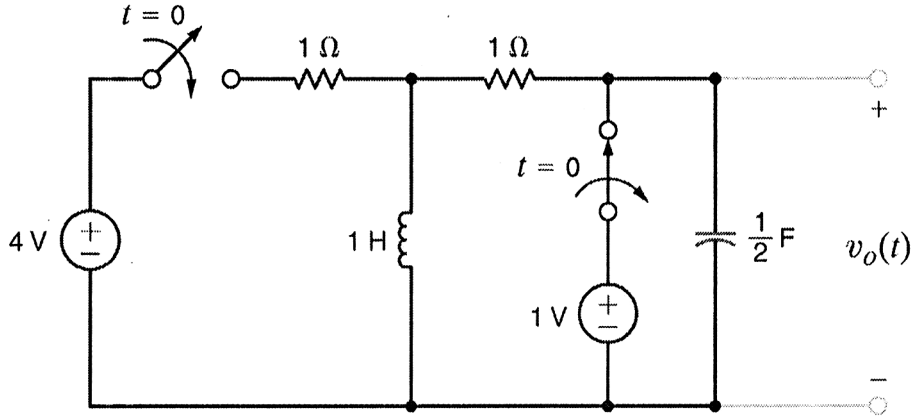

Figure Q5(b)

(c) Consider the magnetically coupled circuit as shown in Figure Q5(c). The reference directions of the current and mutually induced voltages for both the coils are as indicated. For all the possible combinations of the coil orientations show how the polarity of the mutually induced voltage depends on the direction of the inducing current and the dots on the two coupled coils.

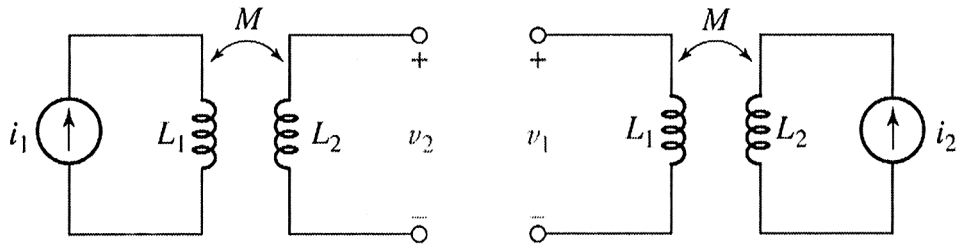

Figure Q5(c)

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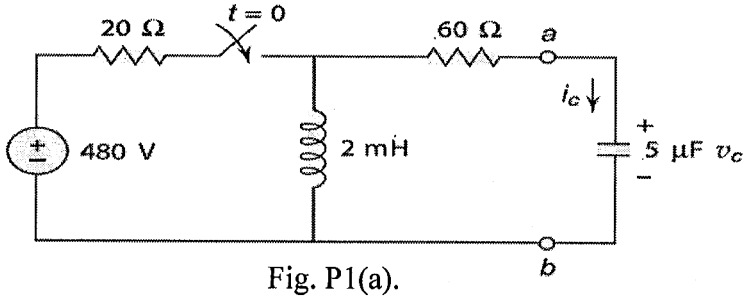
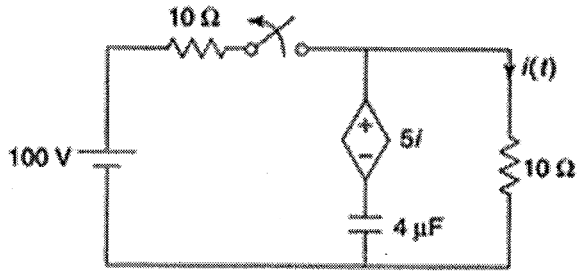
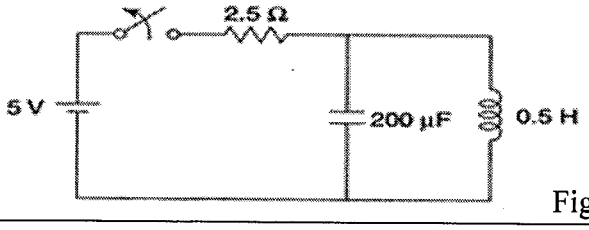
B.E. ELECTRICAL ENGINEERING SECOND YEAR FIRST SEMESTER
SUPPLEMENTARY EXAM 2023
SUBJECT: - CIRCUIT THEORY

Time: Three hours

Full Marks: 100
(**50** marks for this part)

Use a separate Answer-Script for each part

No. of Question		PART -II Answer any Three (Two marks reserved for well organized answers)	Marks
1)	(a)	Consider a circuit shown in Fig. P1(a). Find the capacitor current that results from closing the switch. The energy stored in the circuit prior to closing is zero. Sketch the graph of the capacitor current.  Fig. P1(a).	(12)
	(b)	Write a note on the effectiveness of s-domain transformation of circuit analysis problems.	(4)
2)	(a)	For the network shown in Fig. P2(a) find the current *i(t)* when the switch is opened.  Fig. P2(a).	(8)
	(b)	In the network of Fig. P2(b) the switch is closed and steady-state is attained. At t=0, switch is opened. Determine the current through the inductor.  Fig. P2(b).	(8)

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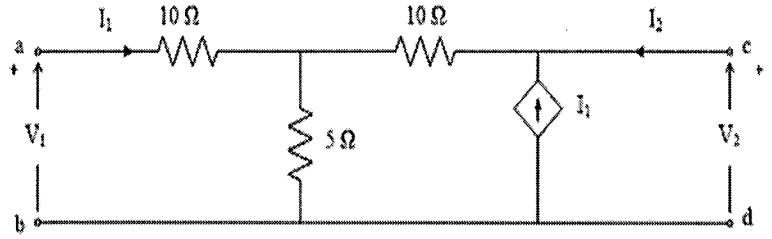
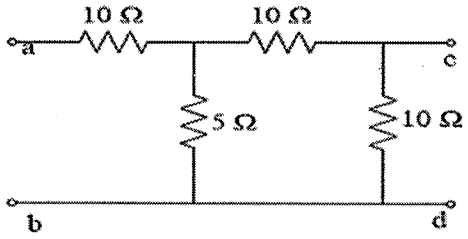
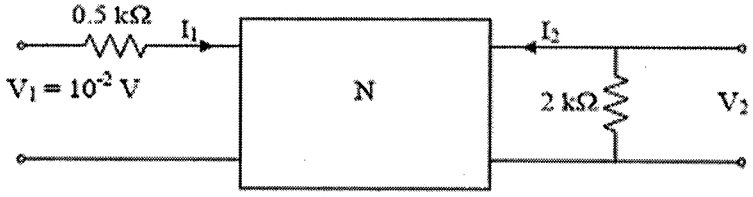
3)	(a)	Determine the Z parameters of the network shown in Fig. P3 (a).  Fig.P3(a)	(8)
	(b)	Derive the condition for reciprocity and symmetry of a two-port network in terms of its transmission parameters.	(8)
4)	(a)	A network is shown in Fig.P4(a). It is cascaded with another network having the same circuit as of the previous one. Obtain the transmission parameters of the resulting circuit when both the circuits are in cascade.  Fig.P4(a).	(10)
	(b)	Obtain the hybrid parameters in terms of ABCD parameters.	(6)
5)	(a)	The hybrid parameter of a two port network of Fig. P5(a) are h_{11} = 1 kΩ, h_{12} = 0.003, h_{22} = 50 μΩ and h_{21} = 100. Find V_2.  Fig.P5(a)	(10)
	(b)	Derive the formula used to express the Laplace transform of a periodic function.	(6)