Ref. No.: Ex/EE/PC/B/T/212/2024(S)

B. E. ELECTRICAL ENGINEERING 2ND YEAR 1ST SEMESTER
SUPPLEMENTARY EXAMINATION, 2024

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

Part I (50 marks)

Use Separate Answer-script for Each Part

Answer ***Any Three*** questions (3×16)

(***Two*** marks are reserved for well-organized answers)

Question No.			Marks
Q1	(a)	For the circuit shown in Figure Q1(a) find I_0 following the concept of Super node.	8

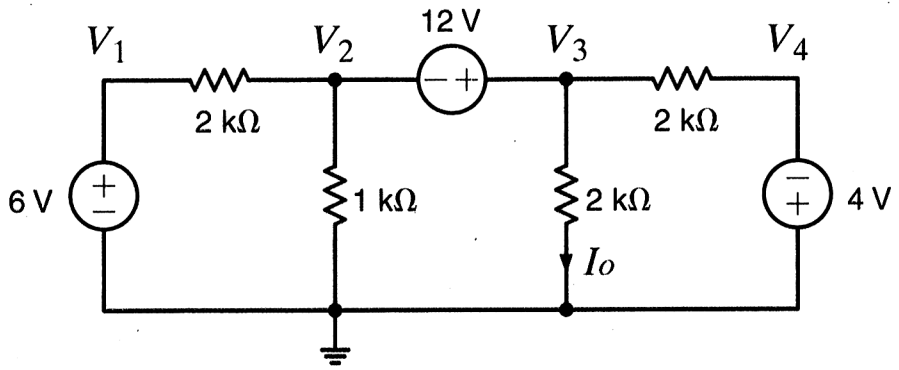

Figure Q1(a)

(b) Determine the current through the 8-V battery using Mesh analysis for the circuit shown in Figure Q1(b). 8

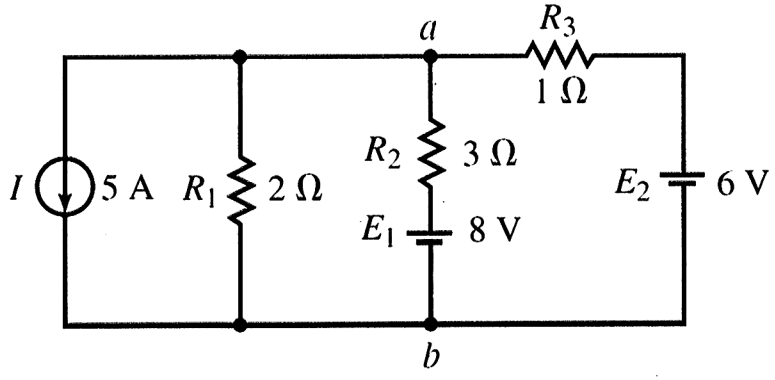

Figure Q1(b)

Q2 (a) Consider the circuit shown in Figure Q2(a) that contains a current-controlled-current-source. Find the value of current i. 8

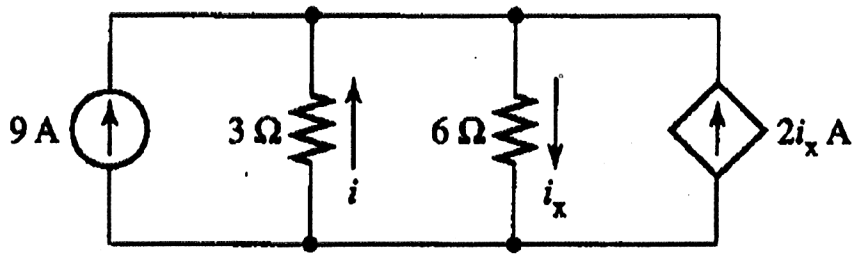

Figure Q2(a)

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Q2 (b) If the indicated portion in the circuit of Figure Q2(b) is to be replaced with a current source and a 240-ohm shunt resistor, determine the magnitude and direction of the required current source. 8

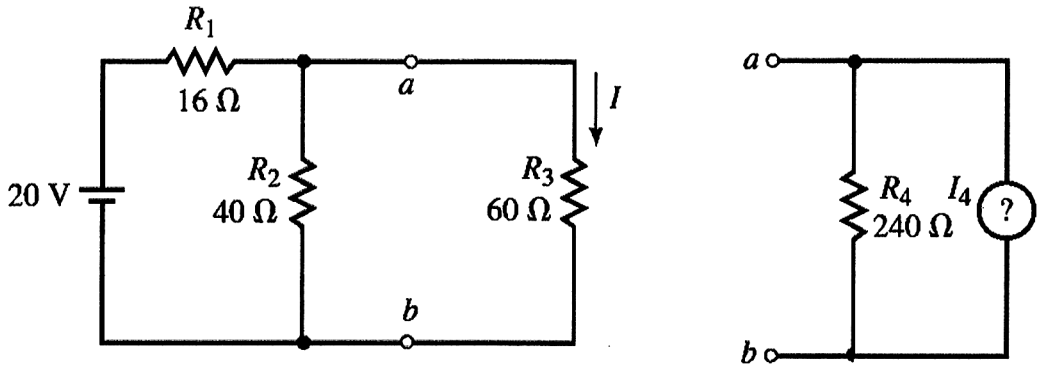

Figure Q2(b)

Q3 (a) For the circuit shown in Figure Q3(a) obtain the Thevenin equivalent circuit across the terminal A-B. 8

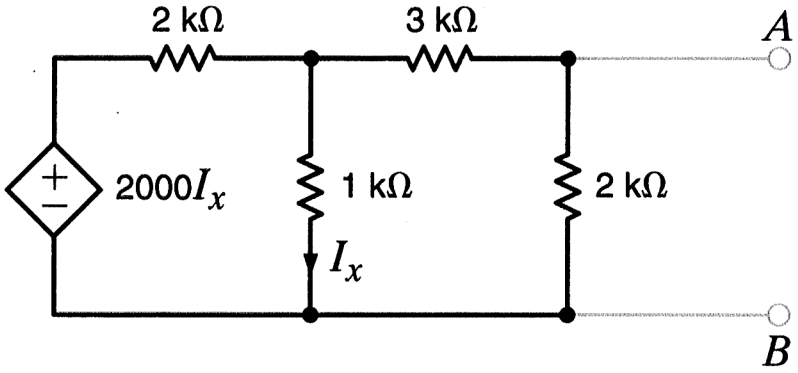

Figure Q3(a)

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

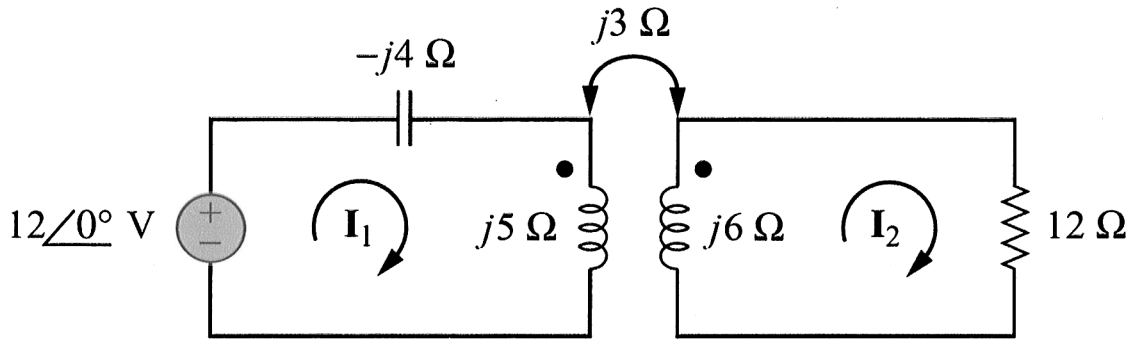

Figure Q3(b)

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Q4 (a) Find the total inductance of the series coils shown in Figure Q4(a). 4

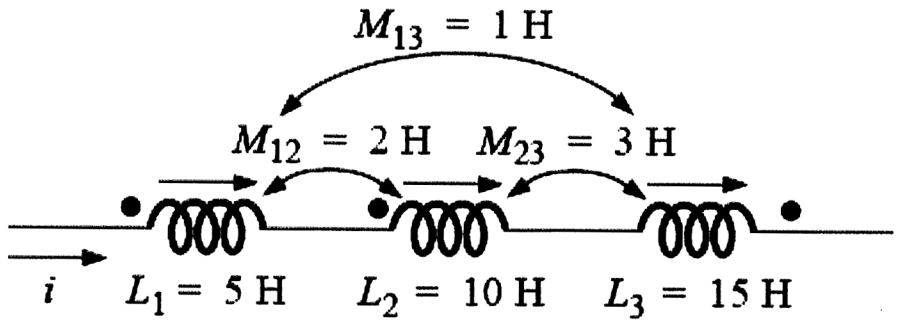

Figure Q4(a)

(b) Draw a graph and obtain the Incidence Matrix for the network shown in Figure Q4(b). 6

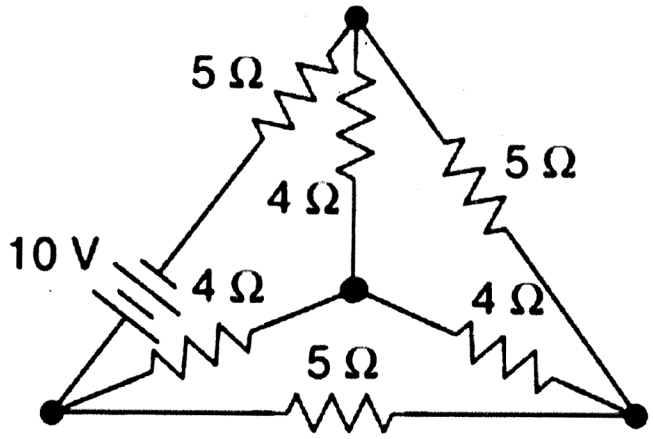

Figure Q4(b)

(c) For the network shown in the Figure Q4(c), draw a graph of the network and obtain the fundamental Cut-Set matrix. 6

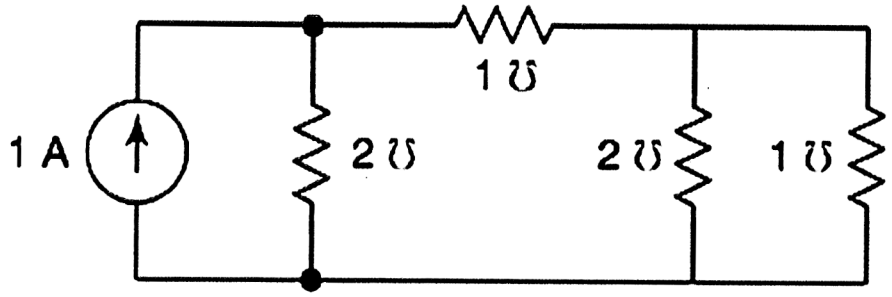

Figure Q4(c)

Q5 (a) For the network shown in the Figure Q5(a), draw a graph of the network and prepare a Tie-Set schedule. 6

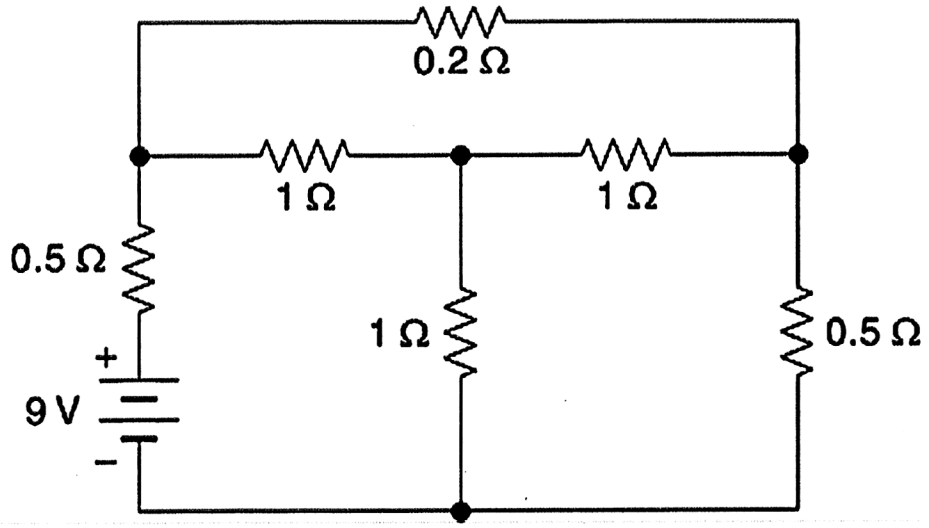

Figure Q5(a)

(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). 10

Using Laplace Transform technique obtain the expression for $V_0(s)$.

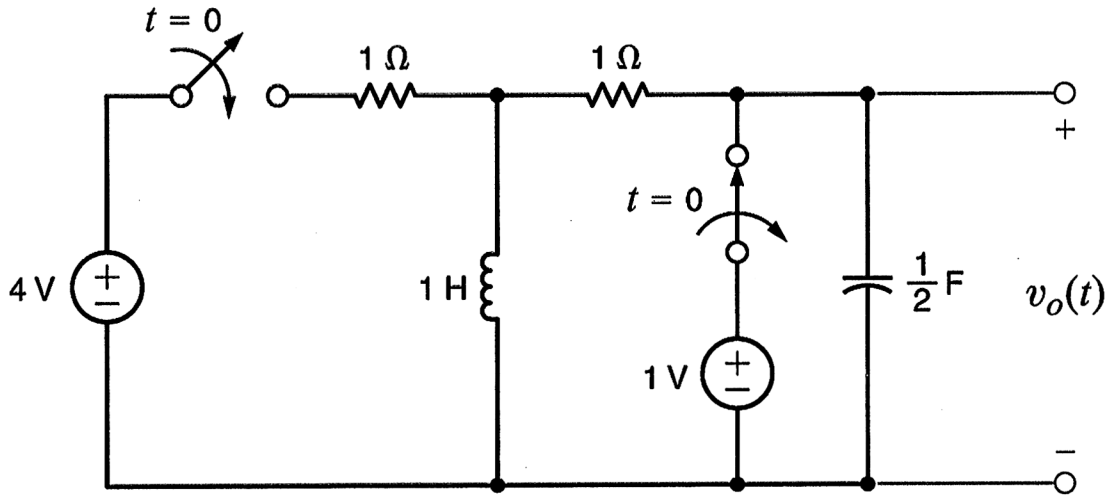

Figure Q5(b)

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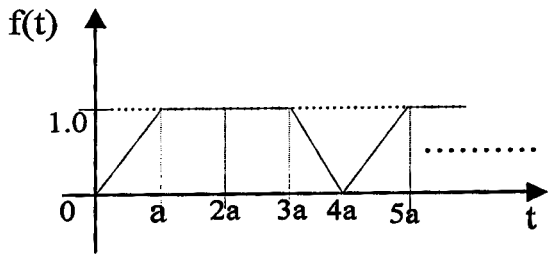
Time: Three hours

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)	Find the current *i(t)* in a series RLC circuit comprising of a resistor R = 4 Ω, inductor L = 1 H and capacitor C = 1/3 F when each of the following source voltage signals is applied: (i) 9r(t-2) (ii) 4u(t-3) and (iii) 2δ(t-1).	(8)
	b)	Find the Laplace transform of the waveform given in Fig P-1(b). Derive the formula you used.  Fig. P -1(b)	(8)
2)	a)	For the circuit given in Fig.P-2(a) the circuit parameters are R = 10kΩ, L = 800 mH and C = 100nF. The switch is closed at *t=0.* If V_{dc} = 70 V, find: (i) $v_0(t)$ for $t \geq 0$ (ii) $i_0(t)$ for $t \geq 0$ (iii) Use initial and final value theorems to check the initial and final values of current and voltage.	(10)
	b)	Find the convolution of two identical rectangular pulses. Each rectangular pulse has unit amplitude and duration equal to 2T seconds. Also, the pulse is centered at t=T.	(6)

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Full Marks: 100
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Time: Three hours

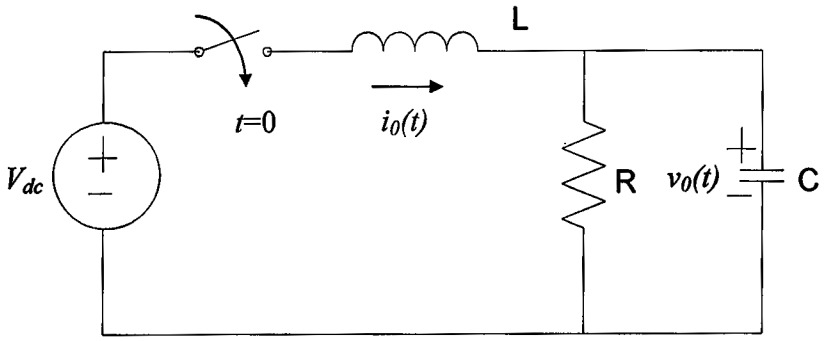

Fig. P -2(a)

3) a) Find the Z-parameters of the circuit given in Fig.P-3(a). (8)

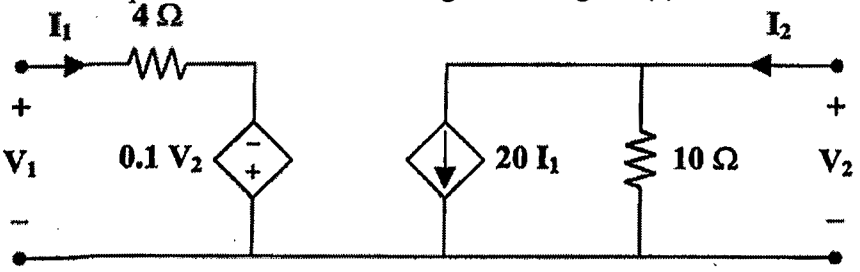

Fig. P-3(a)

b) Determine the condition of reciprocity and symmetry in terms of ABCD parameters. (8)

4) a) Determine the Y-parameter of the network given in Fig.P-4(a). (8)

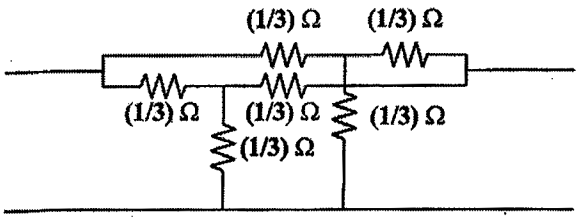

Fig. P-4(a)

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(**50** marks for this part)

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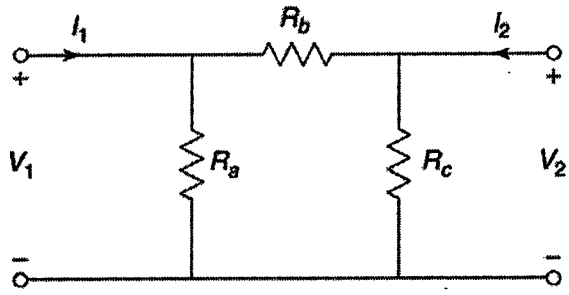
b)	Admittance parameters of the two port network of Fig.P-4(b) are given as: Y_{11}=0.09 mho, Y_{12}=Y_{21}= -0.05 mho, and Y_{22}=0.07 mho. Determine the values of R_a, R_b, R_c.  Fig. P-4(b)	(8)
5)	Write short note on: **(any two)** (a) Significance to Two-Port Network Model in Electrical Engineering (b) H-parameter representation of BJT and the advantage gained thereof. (c) Complex frequency.	(8+8)