Ref No.:Ex/EE/5/T/112/2024(S)

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) FIRST YEAR FIRST SEMESTER SUPPLEMENTARY EXAM - 2024

SUBJECT: CIRCUIT THEORY

Time: Three Hours | Full Marks: 100 (50 Marks for each part)

Use a separate Answer-Script for each part

Two marks for neat and well-organized answers

Question No.	Part-I	Marks

Answer any three questions

1. (a) Explain the following: 4×4
   (i) Static and Dynamic Systems.
   (ii) Linear and Non-Linear Systems.
   (iii) Passive and Causal Network.
   (iv) Bilateral and Unilateral Network

2. (a) Explain the three types of singularity functions. Show how they are related with each other. 8

   (b) In the circuit shown in Fig.Q.2(b) find the voltage and current through the inductor and capacitor respectively, at $t = 0^-, 0^+$ and steady state 8

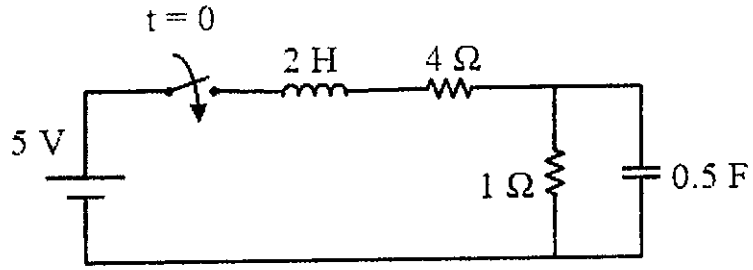

Fig.Q.2(b)

3. (a) Derive and sketch the transformed equivalent of inductance and capacitance with initial conditions. 8

   (b) Find the Laplace transform of the following: 8
   (i) $e^{-at}\cos\omega_0 t\ u(t)$ (ii) $tu(t)$ (iii) $\sin\omega_0 t\ u(t)$ (iv) $t^3 e^{-at}u(t)$

[Turn over

4. (a) State and derive the initial and final value theorem related to Laplace Transform and using them find the initial and final value of the inverse Laplace Transform of the following function 12

$$F(s) = \frac{0.9(s+1)}{2.1s^2 + 5s + 16}$$

(b) Find the Laplace transform of the following signalshown in Fig.Q.4(b). 4

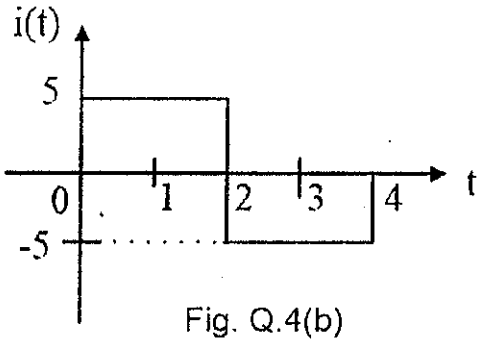

Fig. Q.4(b)

5. (a) Draw a two port network whose y parameters are 8
y11 = - y12 = - y21 = y22 = 1 mho. If two such networks are cascaded determine the y parameter of the overall network.

(b) Obtain the ABCD parameters in terms of Z parameters of a two-port network. 8

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Part II (50 marks)

Question 1 is compulsory

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

Question No. | Marks

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

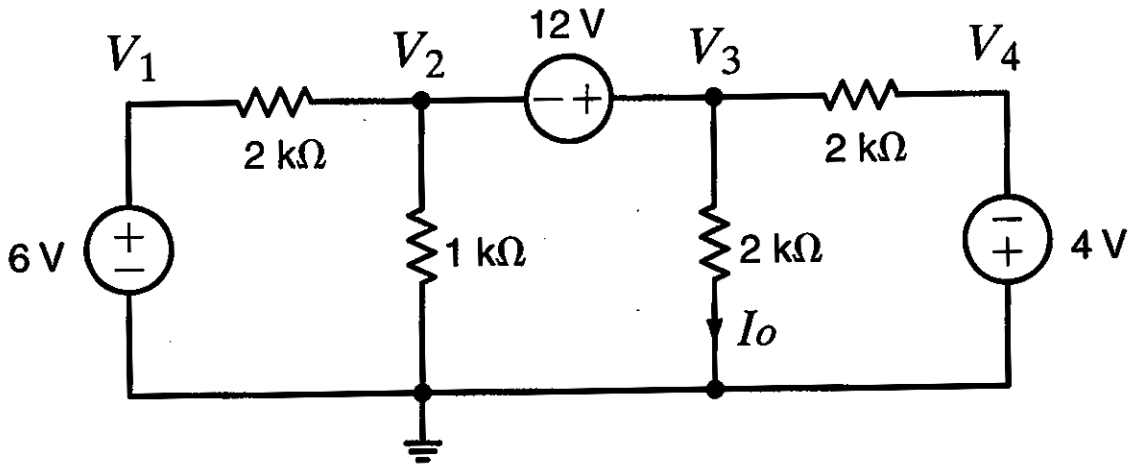

Figure Q1

(a) Determine the value of the current I_o using Loop Analysis technique. 10

OR

(b) Determine the value of the current I_o using Nodal Analysis technique. 10

Q2 (a) For the circuit shown in Figure Q2(a) to find I_o.

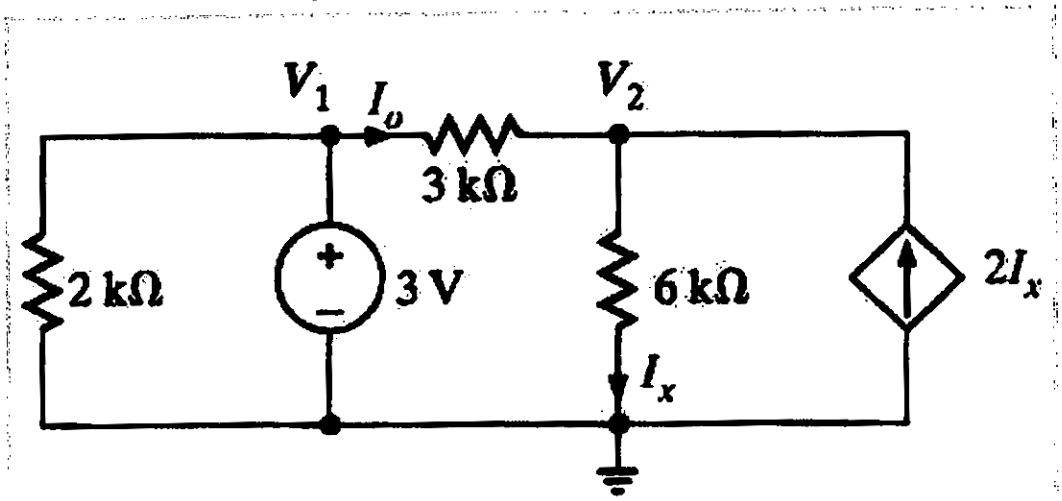

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Figure Q2(a)

Q2 (b) Using Thevenin's Theorem find the voltage V_0 for the circuit shown in Figure Q2(b). 10

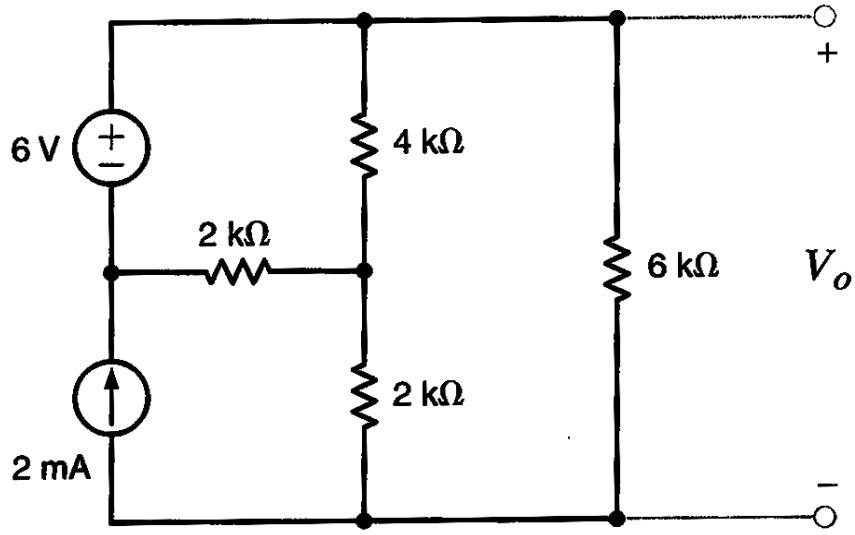

Figure Q2(b)

Q3 (a) Find, using source superposition, the value of V_0 for the circuit shown in Figure Q3(a). 8

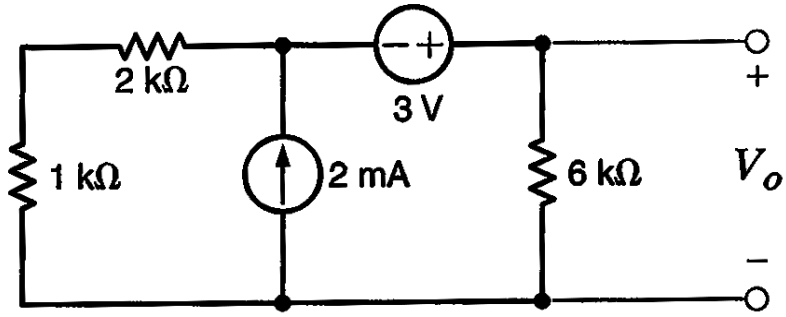

Figure Q3(a)

(b) Find the Norton equivalent for the circuit shown in Figure Q3(b) with respect to the terminals a and b. Determine the current through R_L. 8

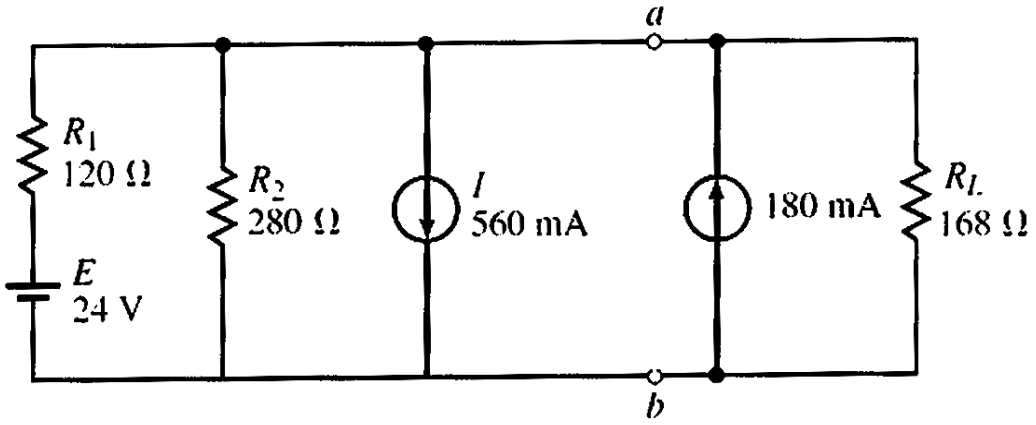

Figure Q3(b)

(c) State and prove Maximum Power Transfer Theorem. 4

Q4 (a) Find I_o in the circuit, as given in Figure Q4(a), by using the concept of source transformation. (There is no mutual coupling between the inductors.) 6

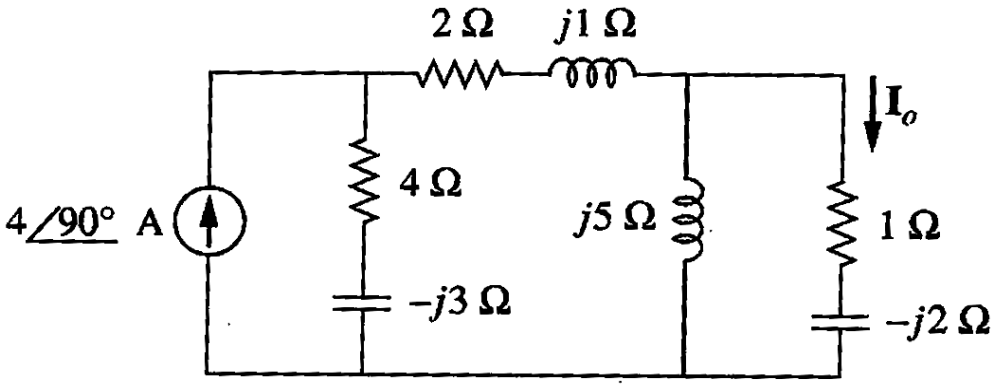

Figure Q4(a)

(b) For the circuit shown in Figure Q4(b) the switch is opened at t=0. Transform the circuit to its s-domain equivalent and obtain the expression for $V_0(s)$. 8

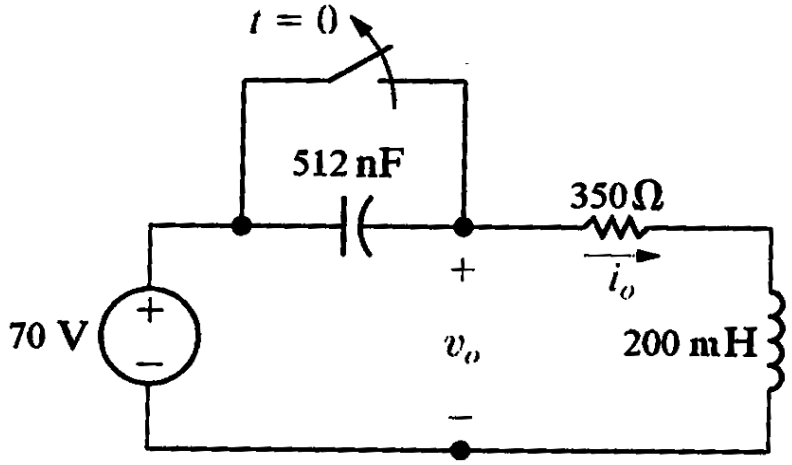

Figure Q4(b)

(c) For the network shown in Figure Q4(c), write a Tie-Set schedule. 6

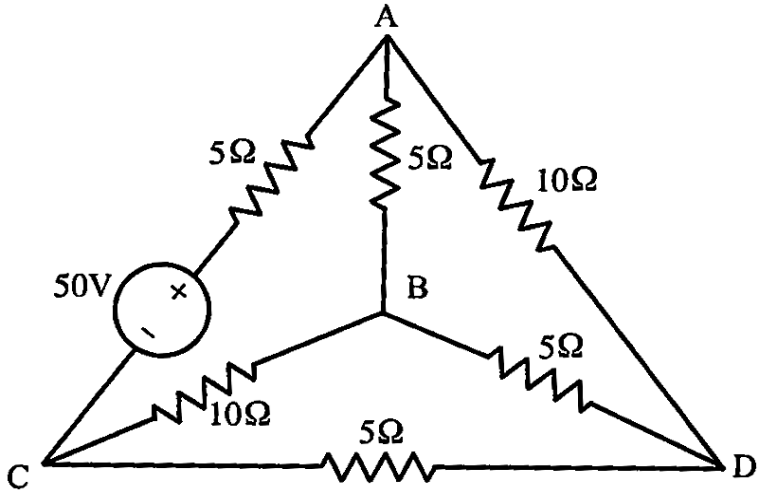

Figure Q4(c)

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Q5 (a) For the circuit shown in Figure Q5(a) determine the currents I_1 and I_2. 8

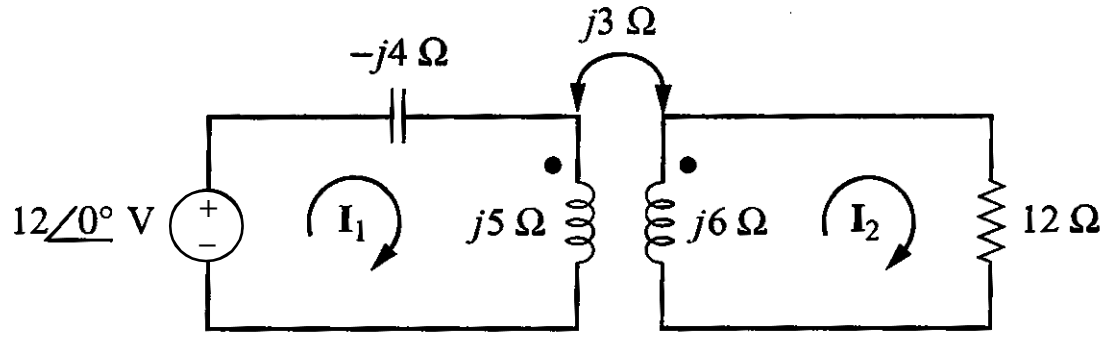

Figure Q5(a)

(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 Q5(c), obtain fundamental Cut-Set Matrix. 8

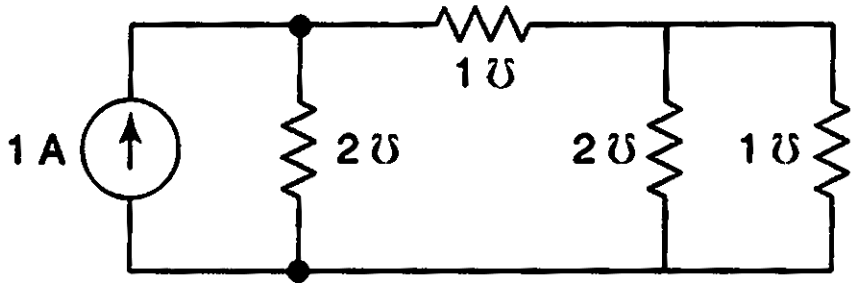

Figure Q5(c)