Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III EXAMINATION – SUMMER 2025

Subject Code:3131103 **Date:06-06-2025**

Subject Name:Network Theory

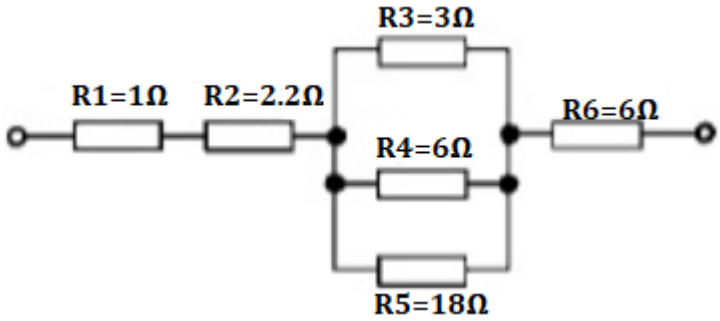
Time:02:30 PM TO 05:00 PM **Total Marks:70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1 **(a)** Do as directed: **14**

1) What is mutual-inductance (M)?
2) Find the equivalent resistance for the circuit shown in Figure



3) What is the difference between the unilateral and bilateral network?
4) Justify: The inductors act as an open circuit at time t=0+.
5) State Kirchhoff's current law (KCL).
6) What is the condition for reciprocal network for Y-parameters?
7) State Kirchhoff's voltage law (KVL).
8) Define "Tree" of a connected graph.
9) What is co-tree and links?
10) What is the Laplace transform of a unit step signal?
11) What is fundamental cut set matrix?
12) Write the equation for hybrid parameters of a two-port network.
13) For a frequency of 200 Hz, the time period will be_____.
14) Ohm is unit of all of the following except_____.
    A. inductive reactance
    B. capacitive reactance
    C. resistance
    D. capacitance

Q.2 **(a)** What is time constant? What is its significance? **03**

(b) Explain dot convention for coupled coils with suitable example. **04**

(c) Find current in 20-ohm resistance in the circuit shown in **figure:1** using superposition theorem. **07**

OR

(c) For the network shown in **figure:2** the switch k is closed at t=0, also it reaches a steady state with the switch k open. Find the current i(t) for all time. **07**

Q.3 **(a)** State and explain initial value theorem of Laplace transform. **03**

(b) Explain characteristic of an ideal voltage source. **04**

(c) Calculate the node voltages for all the nodes V1, V2 and V3 shown in **figure: 3** using nodal analysis. **07**

OR

Q.3 **(a)** Derive the conduction of maximum power transfer for the variable resistance as a load circuit. **03**

(b) In the Network shown in **figure:4** steady state is reached with switch k is open. At t=0, the switch is closed. For the element values given determine ***Va(0-)*** and ***Va(0+).*** **04**

(c) Find the Z parameters for the network shown in **figure:5**. **07**

Q.4 **(a)** Define fundamental loop and cut-set. **03**

(b) Find the current in 4Ω resistor for the circuit shown in **figure:6** using Thevenin's theorem and also find maximum power dissipation by the 4Ω. **04**

(c) For the circuit of **figure:7**, using mesh analysis find the mesh currents $I1$, $I2$ and $I3$. Also find voltage v across a dependent source. **07**

OR

Q.4 **(a)** Find the inverse Laplace Transform of: **03**

$$F(s) = 1 + \frac{4}{S+3} - \frac{5s}{s^2+25}.$$

(b) Find the Norton's equivalent with respect to terminals $a - b$ in the circuit shown in **figure: 8.** **04**

(c) In the network of the **figure:9**, the switch K is in position a for a long time. At $t = 0$, the switch is moved from a to b. Find $v_2(t)$ with assumption that the initial current in the 2 H inductor is zero. **07**

Q.5 **(a)** Find Laplace transform of $f(t) = t^2u(t)$. **03**

(b) Explain the terms: **04**

1) Bilateral
2) Passive
3) Oriented graph
4) Time invariant

(c) For the network shown in **figure:10** draw the oriented graph. Also obtain incidence matrix (A), fundamental tie-set matrix (Bf) and fundamental cut-set matrix (Qf). **07**

OR

Q.5 **(a)** Obtain Laplace transform of (1) Unit Impulse function (2) Unit Ramp function (3) $\sin \omega t$. **03**

(b) Determine h-parameters in terms of z-parameters. **04**

(c) In the network of **figure:11**, determine i_x. **07**

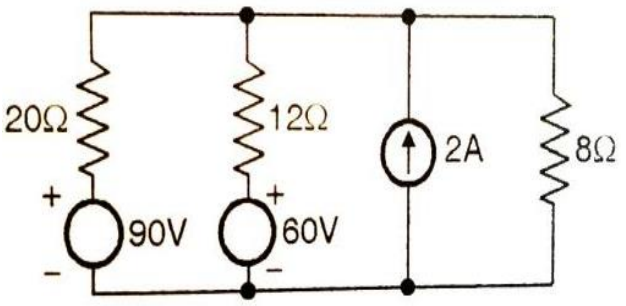


Fig:1

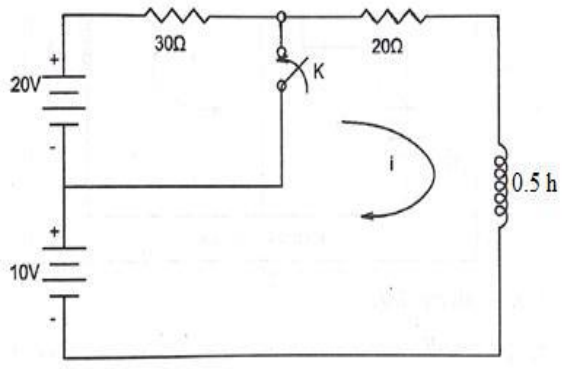


Fig:2

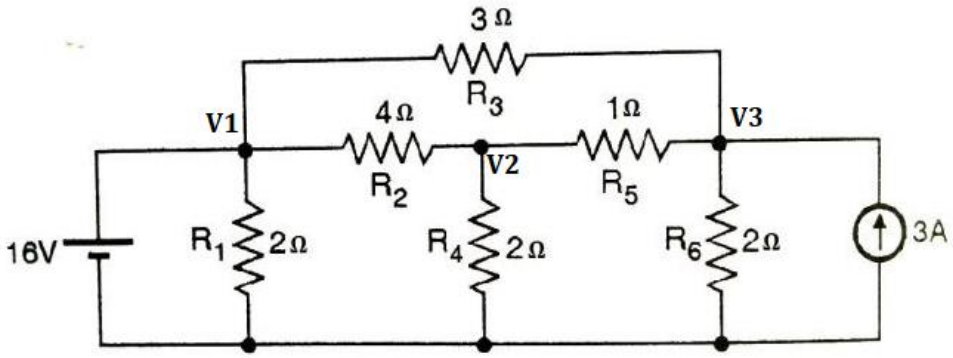


Fig:3

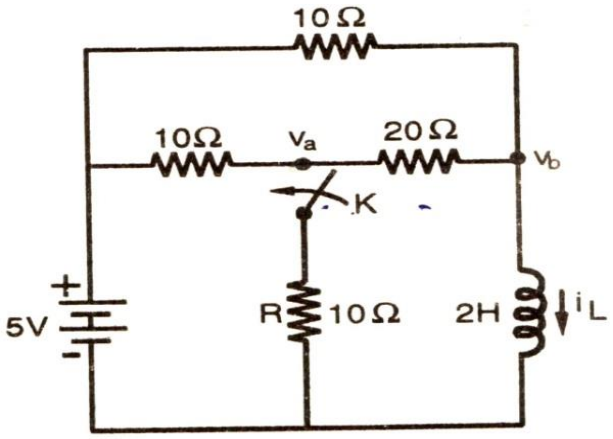


Fig:4

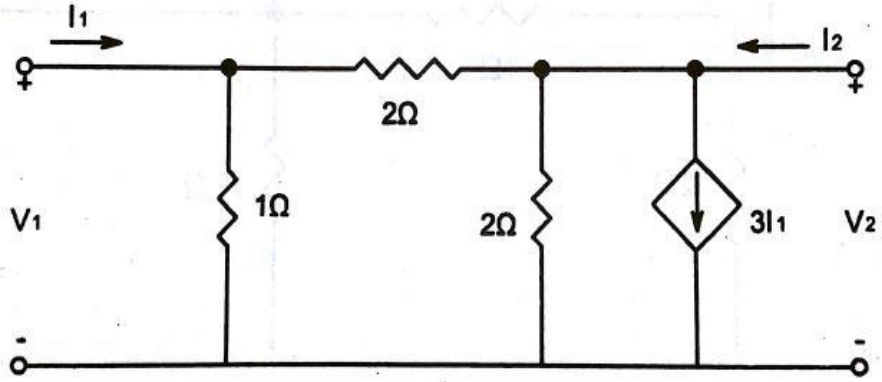


Fig:5

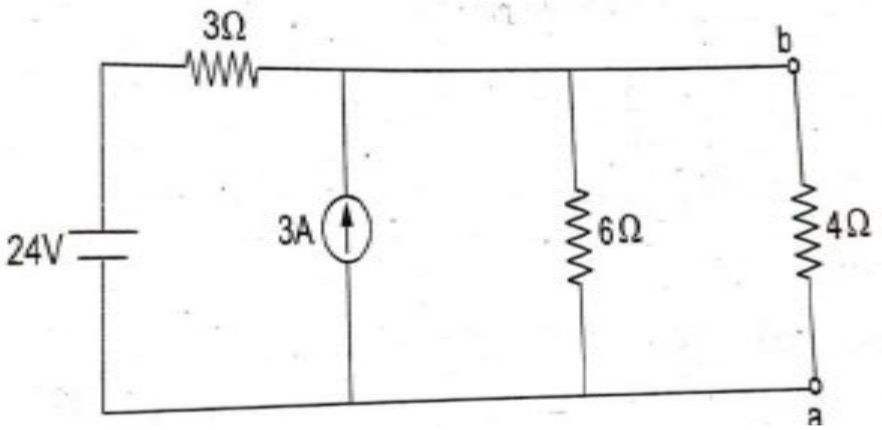


Fig:6

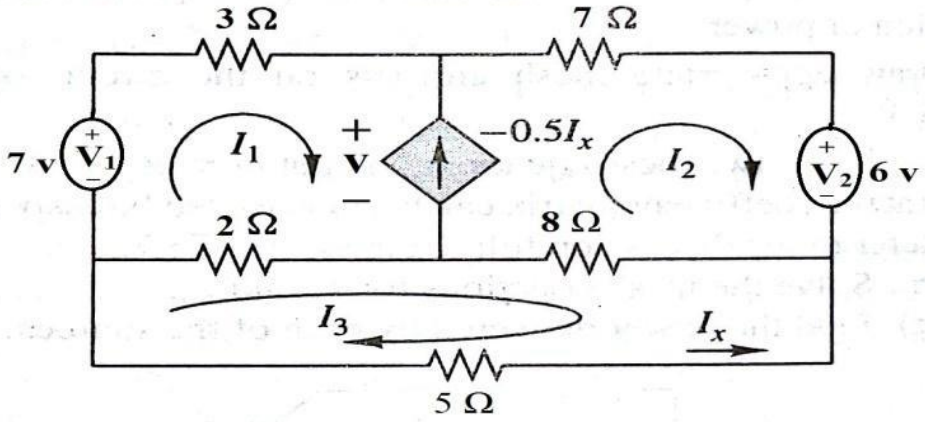


Fig:7

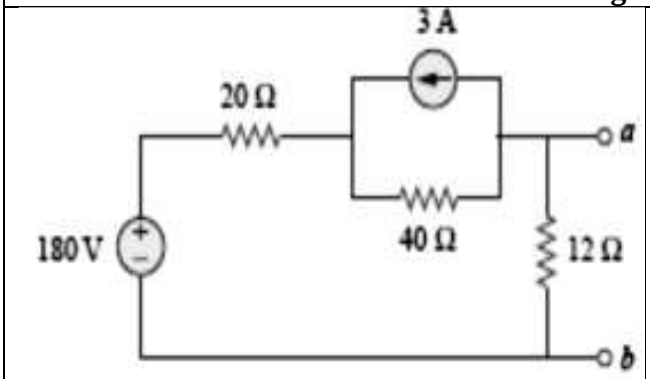


Fig:8

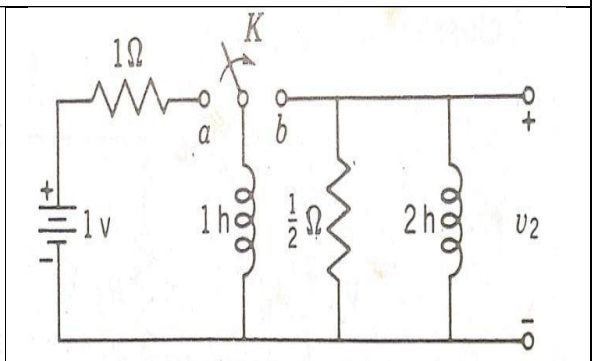


Fig:9

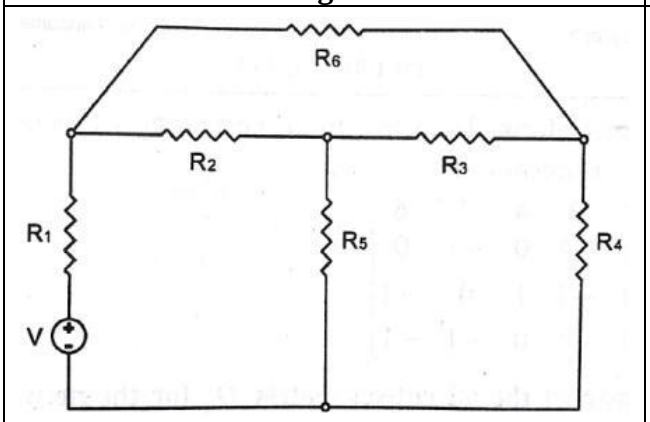


Fig:10

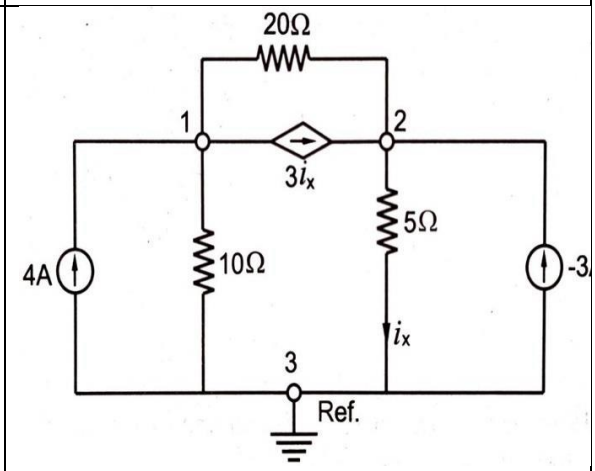


Fig:11

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