

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 3 – EXAMINATION – SUMMER 2026

Subject Code: 3131103

Date: 02/07/2026

Subject Name: Network Theory

Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

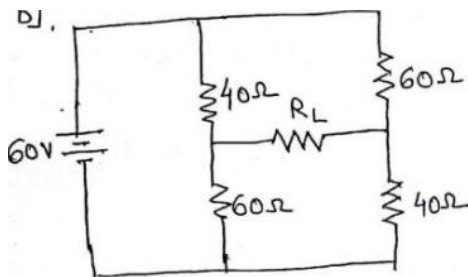
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1** (a) Define ideal and practical current sources. Explain source transformation. 03
 (b) Define EMF and potential difference with example. 04
 (c) List Source transformation techniques rules 07

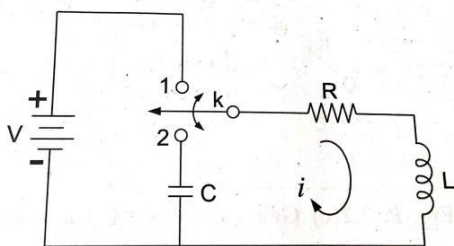
- Q.2** (a) Explain superposition theorem with example. 03
 (b) A 5V DC source is connected to a series RC circuit with $R=2k\Omega$ and $C=10\mu F$ at $t=0$. Assume the capacitor was initially charged to 2V ($v_C(0^-)=2V$). Calculate the voltage across the capacitor at $t=50ms$ and the current through the resistor at $t=0^+$. 04
 (c) State and explain maximum power transfer theorem. Also derive the condition for maximum power transfer to the load for DC and AC circuits. 07

OR

- Q.2** (c) State and apply Thevenin's Theorem to determine equivalent. 07



- Q.3** (a) Explain initial conditions in inductors/capacitors. 03
 (b) List advantages of Laplace transformation method over classical method. 04
 (c) In the network shown in figure, the switch k is changed from position 1 to 2 at $t=0$. Find values of i , di/dt and d^2i/dt^2 at $t=0^+$ if $R=1000\Omega$, $L=1H$, $C=0.1\mu F$ and $V=100V$. 07

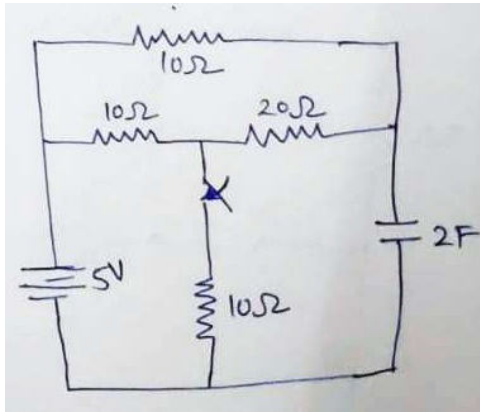


OR

- Q.3** (a) What are poles & zeros? Example. 03
 (b) List property of Laplace Transform. 04

- (c) The network shown in fig is in steady state with switch k is opened. At $t=0$, the switch is closed. For the element values given, determine the values of $V_a(0^-)$ and $V_a(0^+)$.

07



Q.4 (a) Define z-parameters.

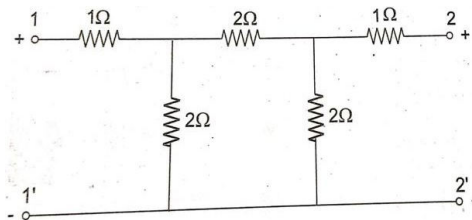
03

(b) Derive relation between z & y.

04

(c) Calculate Y parameters

07



OR

Q.4 (a) What are ABCD parameters?

03

(b) Explain admittance parameters.

04

(c) Derive ABCD for cascaded two-port networks.

07

Q.5 (a) Explain graph, subgraph, planar graph.

03

(b) Define fundamental cut-set matrix.

04

(c) Test PR function $F(s) = 1 / (s+1)$

07

OR

Q.5 (a) Define 1) Tree 2) Connected Graph 3) Co-tree

03

(b) Define dual network with example.

04

(c) Test whether polynomial is Hurwitz : s^2+3s+2

07

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

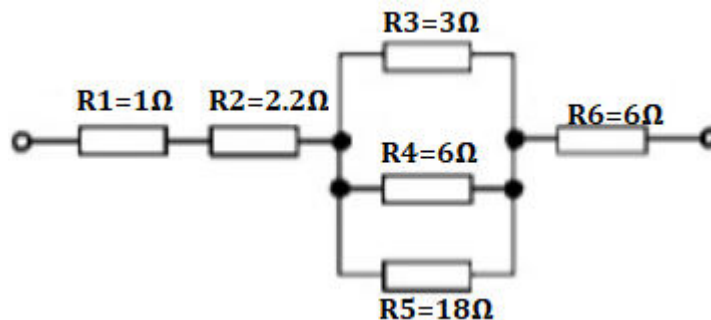
Instructions:

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 V_1 , V_2 and V_3 shown in **figure:3** using nodal analysis.

07

OR

- Q.3** (a) Derive the condition 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 $V_a(0^-)$ and $V_a(0^+)$. 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 I_1 , I_2 and I_3 . Also find voltage v across a dependent source. 07

OR

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

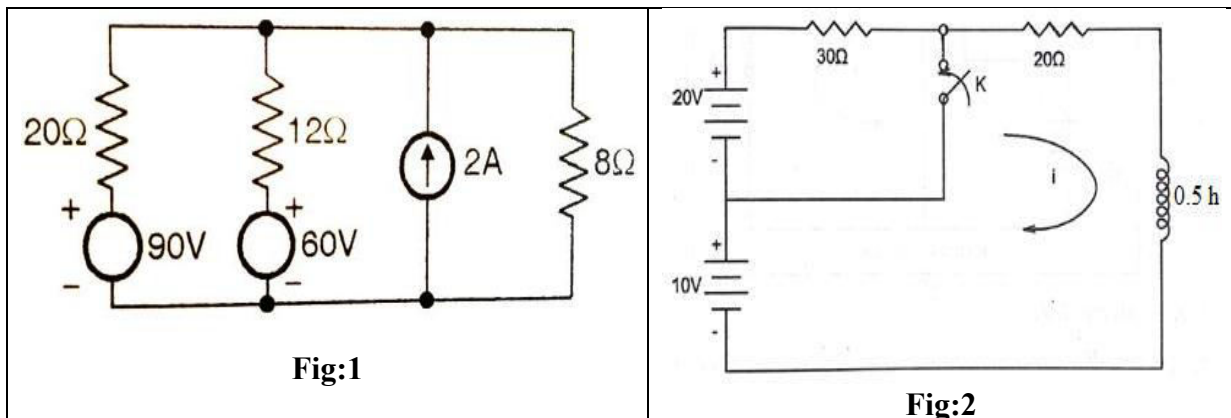
$$F(s) = 1 + \frac{4}{s+3} - \frac{5s}{s^2+25}$$

 (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 $f(t) = t^2 u(t)$. 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 (B_f) and fundamental cut-set matrix (Q_f). 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



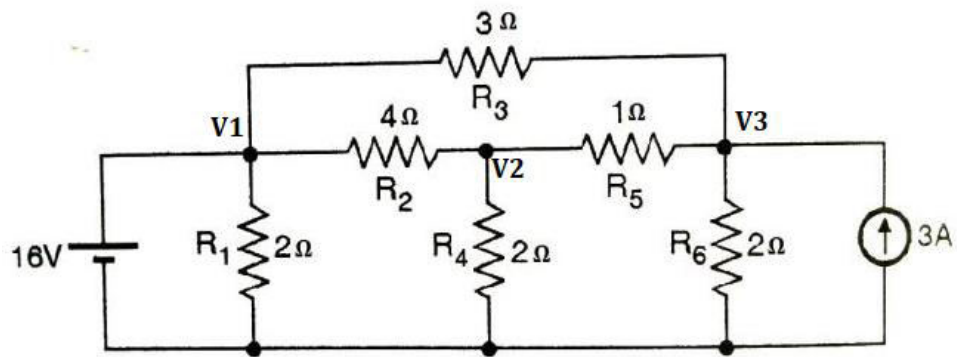


Fig:3

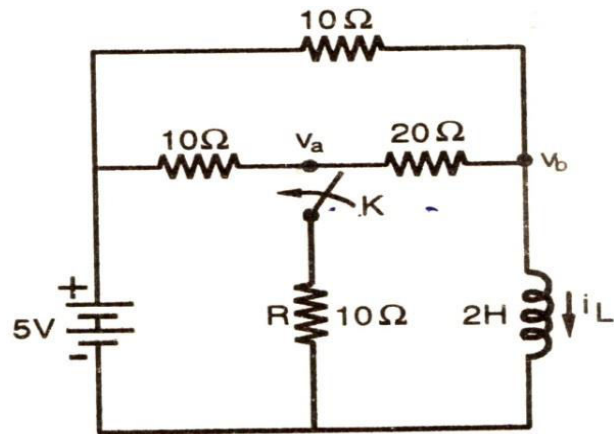


Fig:4

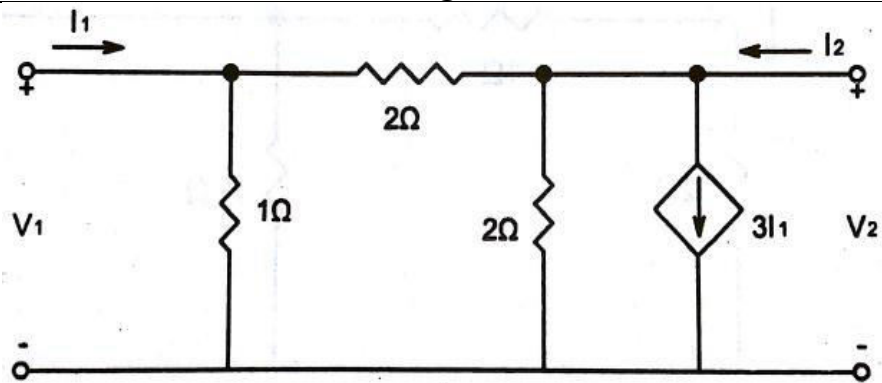


Fig:5

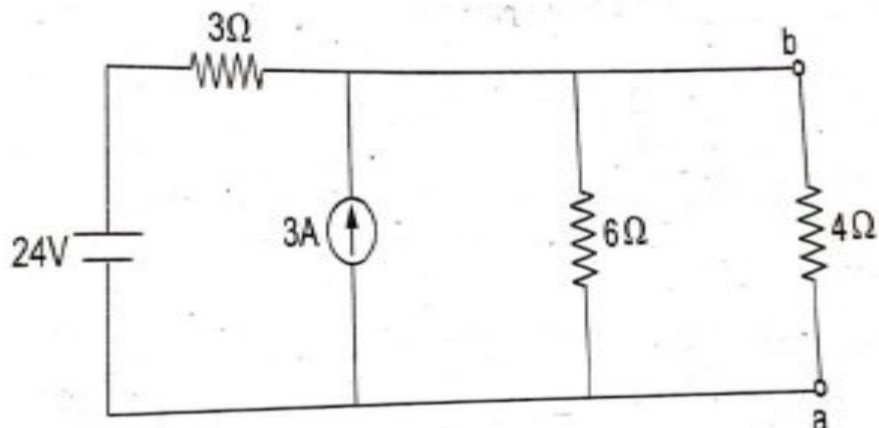


Fig:6

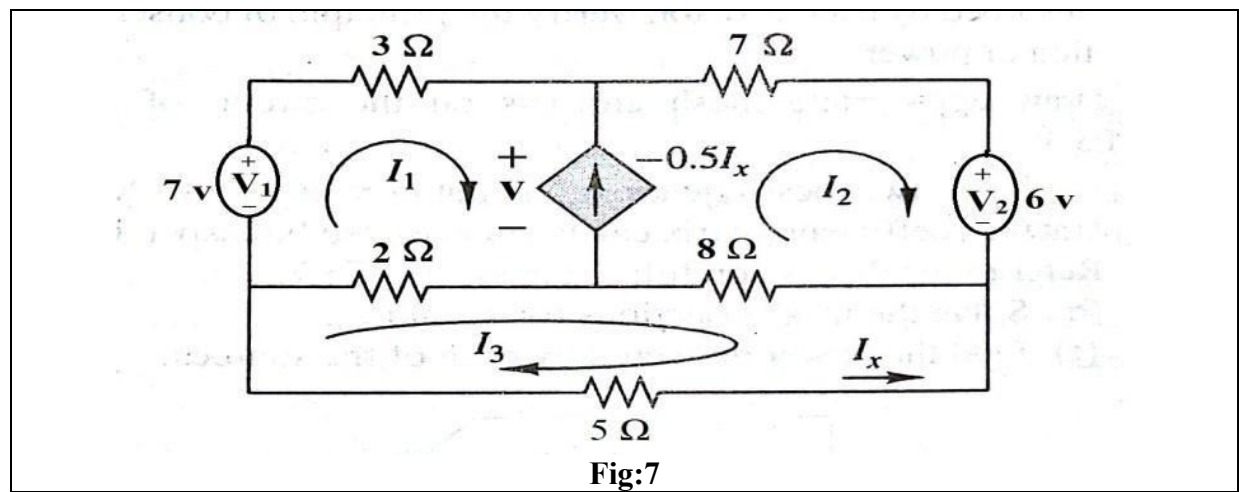


Fig:7

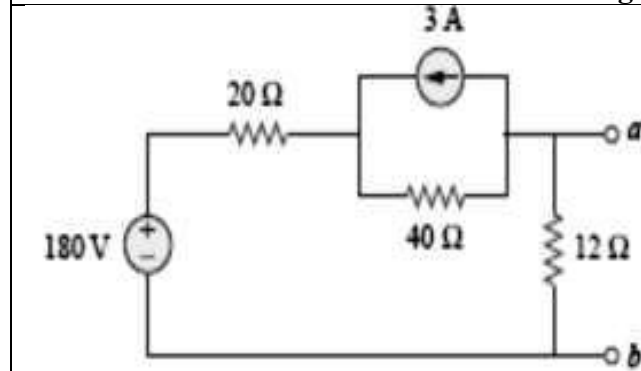


Fig:8

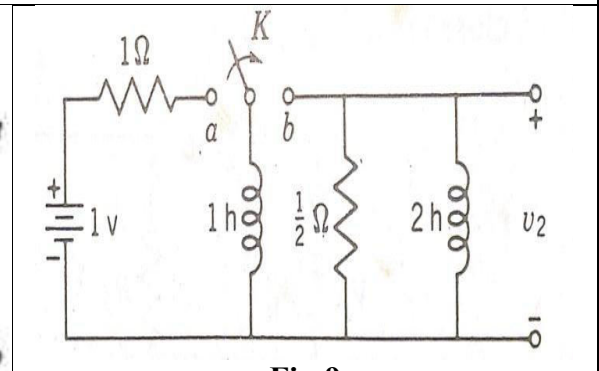


Fig:9

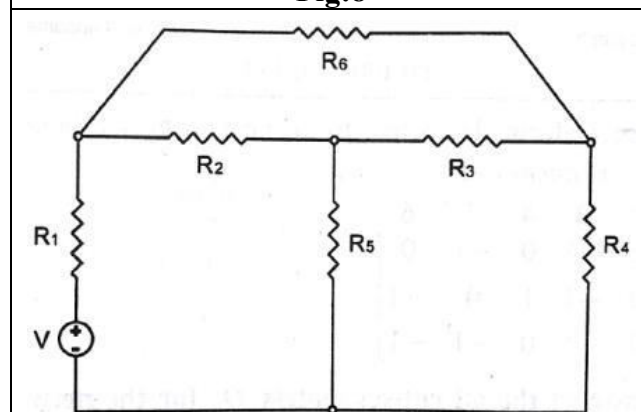


Fig:10

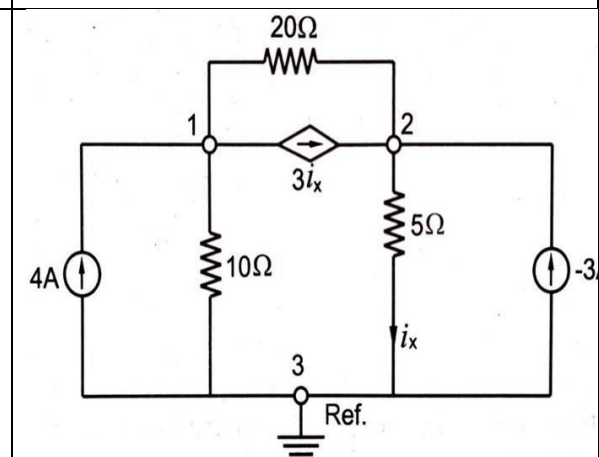


Fig:11

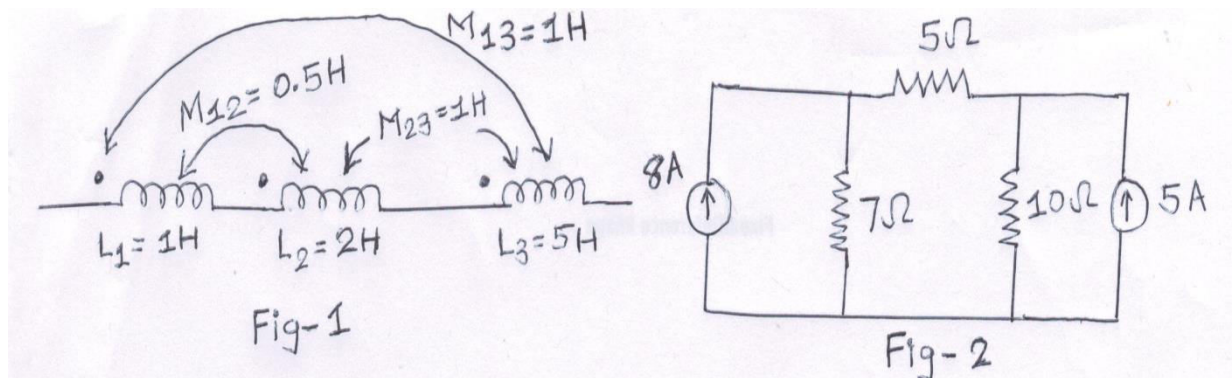
GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III (NEW) EXAMINATION – SUMMER 2024****Subject Code:3131103****Date:06-07-2024****Subject Name: Network Theory****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

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.

		Marks
Q-1	(a) Discuss the following.	03
	(i) Linear and Nonlinear elements	
	(ii) Bilateral and Unilateral elements	
	(iii) Active and Passive elements	
	(b) Find the total inductance of the three series connected coupled coils as shown in Figure 1.	04
	(c) Name the three parameters of electric Network. Discuss the characteristics of each one of them. Write equation for voltage-current and energy relation.	07
Q-2	(a) Explain Ideal and Practical energy sources.	03
	(b) Use nodal analysis to find the voltages across the 5Ω resistor in the network as shown in figure 2.	04
	(c) Determine the mesh currents i_1 , i_2 and i_3 in a network of figure 3.	07
	OR	
	(c) Determine the values of unknown node-to- reference voltages in the circuit as shown in figure 4.	07
Q-3	(a) Explain Why?	03
	(i) The current in an inductor cannot change instantaneously.	
	(ii) The voltage across a capacitor cannot change instantaneously.	
	(b) A series RLC circuit with zero inductor current and zero capacitor voltage is excited by 50V dc source. Find $i(0^+)$ and $\frac{di}{dt} 0^+$ for the circuit as shown in figure 5.	04
	(c) Determine the numerical value of i_2 using source transformation method for the circuit given in figure 6.	07
	OR	
Q-3	(a) How the following elements will behave at $t = 0$ and $t = \infty$. Draw the equivalent network.	03
	(i)Resistor (ii)Inductor (iii) Capacitor	
	(b) In the figure 7, the switch K is closed at $t=0$, $v=100V$, $R=1K\Omega$, $C=0.5 \mu F$, $L=1H$. Find (i) $\frac{di}{dt}$ and (ii) $\frac{d^2i}{dt^2}$ at $t=0$.	04
	(c) For network shown in figure 8, All sources are time invariant. Determine the branch current in 2Ω resistor using source transformation method.	07
Q-4	(a) State and explain: Thevenin's theorem in brief by giving suitable example.	03
	(b) What is time constant? Explain time constant in terms of RL circuit.	04
	(c) Determine the current in $R=1\Omega$ resistor of the network shown in Figure 9, using Norton's theorem.	07

OR

- Q-4** (a) State and explain: superposition theorem in brief by giving suitable example. **03**
 (b) State and explain initial value theorem. **04**
 (c) For the circuit shown in figure 10, determine the value of R_L for maximum power transfer. What will be the value of power transfer under this condition? **07**
- Q-5** (a) Determine h-parameters in terms of z-parameters. **03**
 (b) Define the terms: (i) Planner graph (ii) Non- Planner graph (iii) Loop **04**
 (c) Find z-parameters of the circuit shown in Figure 11. **07**
- OR**
- Q-5** (a) Determine ABCD -parameters in terms of Y-parameters. **03**
 (b) Briefly describe the network synthesis and its application. **04**
 (c) Determine Y-parameters for the network shown in Figure 12. Calculate Z-parameters from Y-parameters. **07**



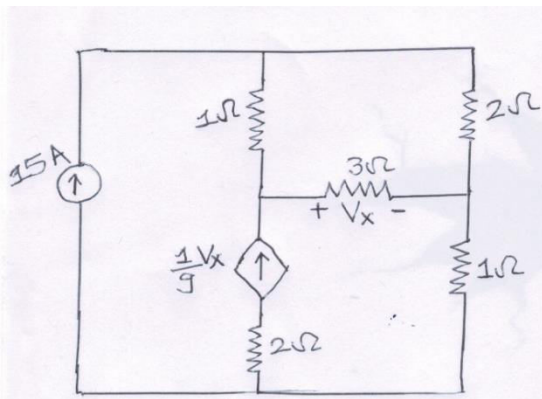


Fig-3

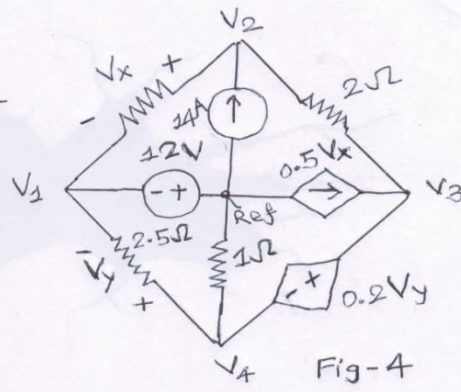


Fig-4

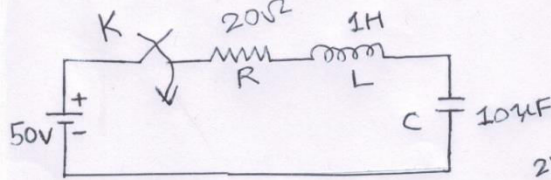


Fig-5

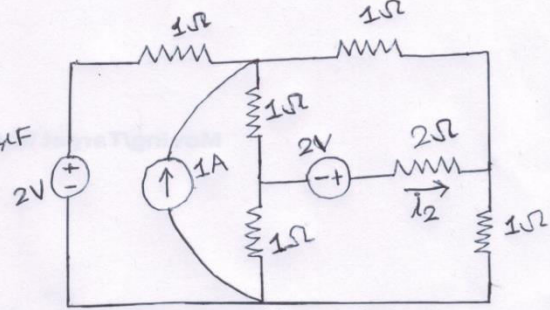


Fig-6

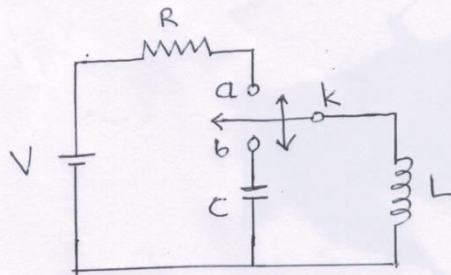


Fig-7

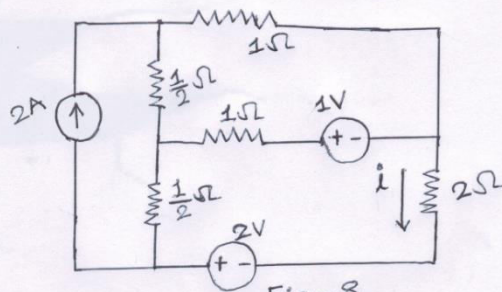


Fig-8

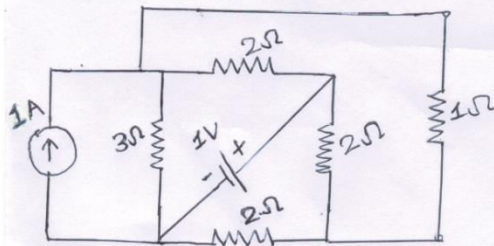


Fig-9

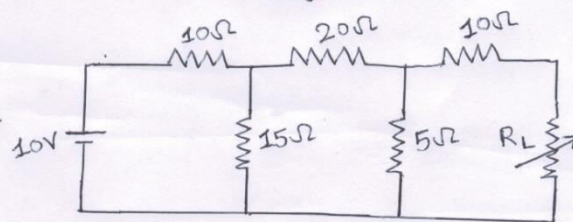


Fig-10

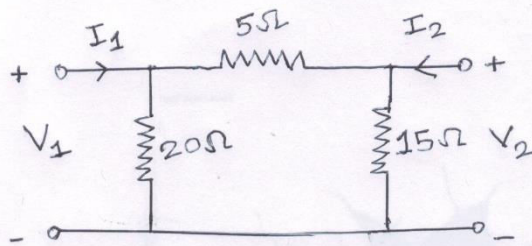


Fig-11

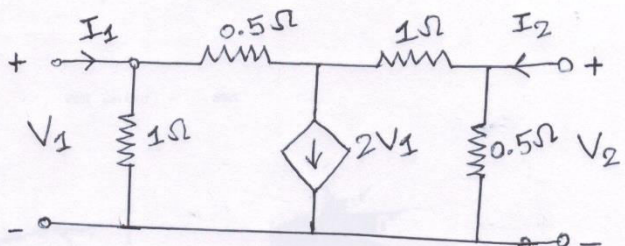


Fig-12

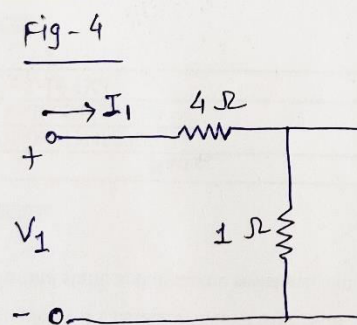
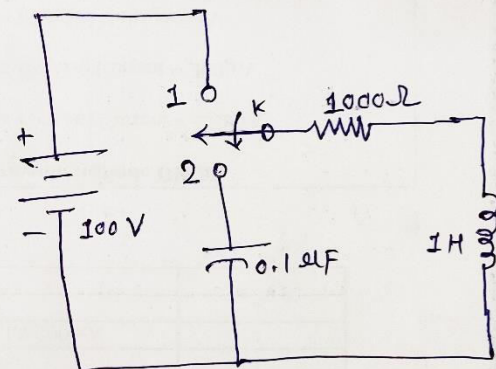
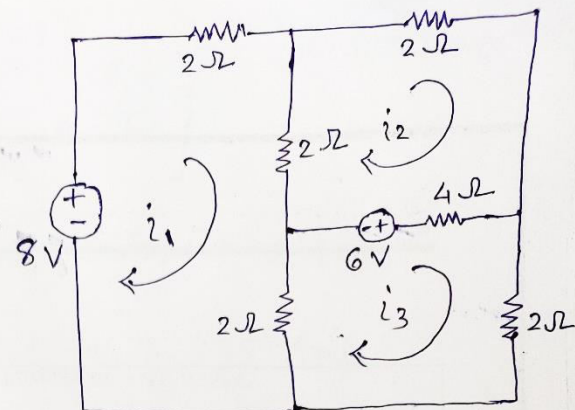
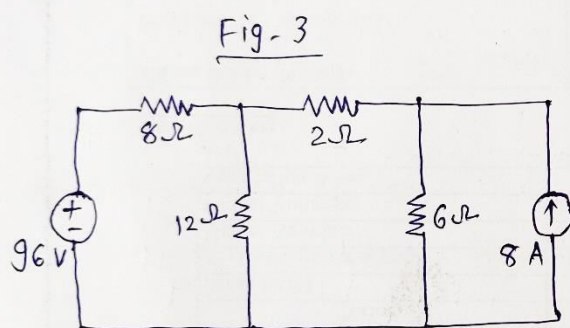
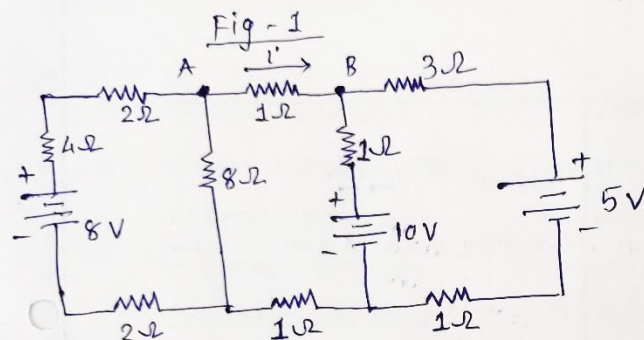
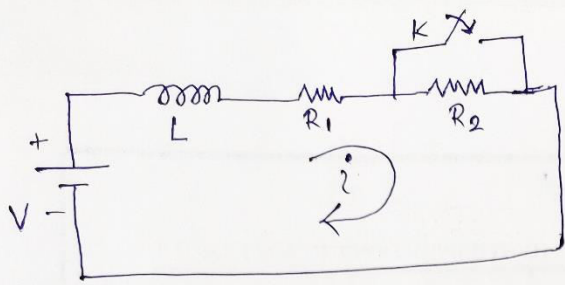
GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III(NEW) EXAMINATION – SUMMER 2023****Subject Code:3131103****Date:01-08-2023****Subject Name:Network Theory****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

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.

		MARKS
Q.1	(a) Explain Ideal and Practical Current and Voltage sources with their characteristics and differentiate them with respect to ideality and practice.	03
	(b) Briefly describe active, passive, lumped and distributed elements.	04
	(c) In the network of Fig-1, the switch k is closed at t=0 and the circuit was in steady state before. Determine particular solution of current i.	07
Q.2	(a) State the possible types of controlled sources and draw their symbols.	03
	(b) Define: Tree, Connected Graph, Co-tree, Sub-graph.	04
	(c) Determine current through 4 Ω resistor using mesh analysis for network of Fig-2.	07
	OR	
	(c) State and explain maximum power transfer theorem with necessary derivation.	07
Q.3	(a) Explain Initial and final conditions of R, L and C elements.	03
	(b) Discuss rules for source transformation.	04
	(c) For the network of Fig-3, obtain current through 1 Ω resistor using Thevenin's theorem.	07
	OR	
Q.3	(a) Define time constant and state its importance in circuit analysis.	03
	(b) State and explain Norton's theorem with an example.	04
	(c) Determine voltage across 6 Ω resistor of Fig-4 using node analysis.	07
Q.4	(a) Explain dot convention for coupled coils with suitable example.	03
	(b) Give statements for Reciprocity Theorem and Superposition Theorem.	04
	(c) Find values of $i, \frac{di}{dt}, \frac{d^2i}{dt^2}$ at t=0+ . for the network of Fig-5, if switch k is changed from position 1 to 2 at t=0.	07
	OR	
Q.4	(a) Derive ABCD parameters in terms of z-parameters.	03
	(b) Determine h-parameters in terms of y-parameters.	04
	(c) Derive relationship between incidence matrix, fundamental tie-set matrix and fundamental cut-set matrix.	07
Q.5	(a) Define: oriented graph, node, tie-set matrix.	03
	(b) Determine h-parameters in terms of z-parameters.	04
	(c) Determine h parameters for network of Fig-6	07

OR

- Q.5 (a) Define: Incident Matrix, cut-set, graph. 03
 (b) Briefly explain PRF. 04
 (c) Derive the condition for the network to be symmetrical for g-parameters. 07



GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– III (NEW) EXAMINATION – SUMMER 2022****Subject Code:3131103****Date:18-07-2022****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.

MARKS

- | | | |
|------------|---|-----------|
| Q.1 | (a) Determine the Laplace transform of $f(t) = e^{-3t} \sin 5t$. | 03 |
| | (b) How the following elements will behave at $t=0$ and $t=\infty$. Draw equivalent network as well. A) Inductor B) Capacitor. | 04 |
| | (c) Determine the mesh currents i_1, i_2 and i_3 in the network shown in fig.1 using mesh analysis. | 07 |
| Q.2 | (a) Determine z-parameters in terms of y-parameters. | 03 |
| | (b) Define 1) Tree 2) Connected Graph 3) Co-tree 4) Sub-graph | 04 |
| | (c) State and explain maximum power transfer theorem. Also derive the condition for maximum power transfer to the load for DC and AC circuits. | 07 |
| OR | | |
| | (c) For the network shown in fig.2, the capacitor is initially charged to a voltage V_0 , with the polarity indicated on the diagram. The switch is closed at $t=0$. Determine the particular solution for the current in the circuit. | 07 |
| Q.3 | (a) State and explain Superposition theorem. | 03 |
| | (b) Reduce the network of fig.3 into an equivalent network across terminals AB with one equivalent current source. | 04 |
| | (c) In the network shown in fig.4, the switch k is closed at $t=0$. For the element values given, determine the values of $v_a(0^-)$ and $v_a(0^+)$. | 07 |
| OR | | |
| Q.3 | (a) Derive the condition for network to be reciprocal for ABCD parameters. | 03 |
| | (b) Explain characteristic of an ideal current source. | 04 |
| | (c) In the network of Fig.5, the switch k is closed at $t=0$, a steady state having previously been attained. Find the particular solution for the current. | 07 |
| Q.4 | (a) State and explain initial value theorem of Laplace transform. | 03 |
| | (b) Find the Thevenin's equivalent network across A and B terminal for the fig.6 | 04 |
| | (c) Derive relationship between incidence matrix (A), fundamental tie-set matrix (B_f) and fundamental cut-set matrix (Q_f). | 07 |
| OR | | |
| Q.4 | (a) What is network synthesis? | 03 |
| | (b) Obtain step response to R-L series circuit using Laplace Transformation. | 04 |
| | (c) Find the current in the 5ohm resistor using Norton's theorem from the fig. 7 | 07 |
| Q.5 | (a) Determine the inductance of the individual winding shown in fig.8 and the equivalent inductance when mutual inductance is 8H. | 03 |

- (b) Briefly explain Positive Real Function (PRF). 04
 (c) For the network of Fig.9, determine z-parameters. 07

OR

- Q.5 (a) Define fundamental loop and cut-set. 03
 (b) Derive the condition for network to be symmetrical for g-parameters. 04
 (c) Obtain the general solution and the particular solution for the current $i(t)$ in the fig. 10 .Also, obtain the value of current at time $t=0.1\text{sec}$. 07

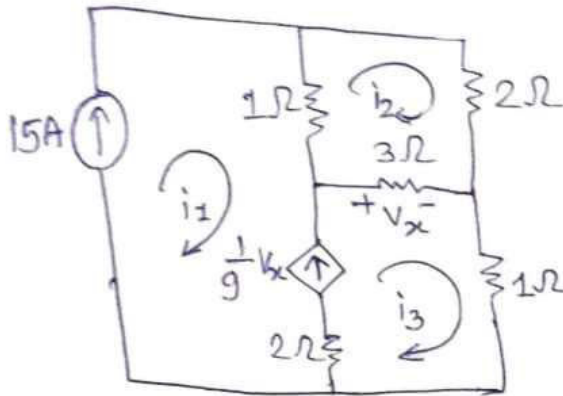


Fig 1.

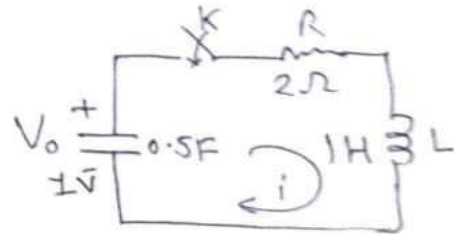


Fig 2

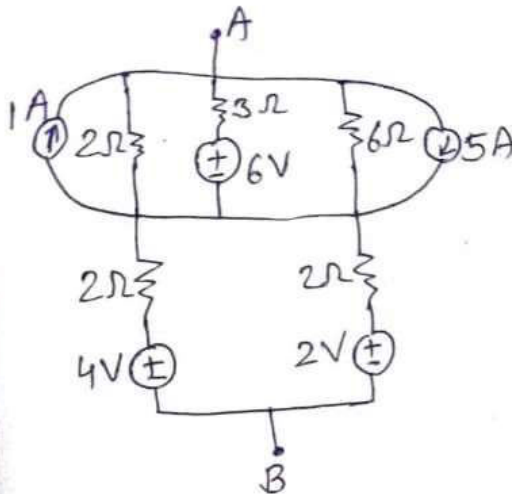


Fig 3

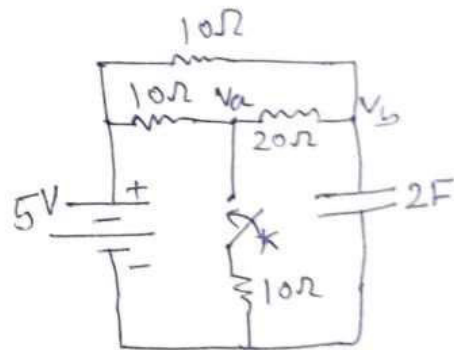


Fig 4

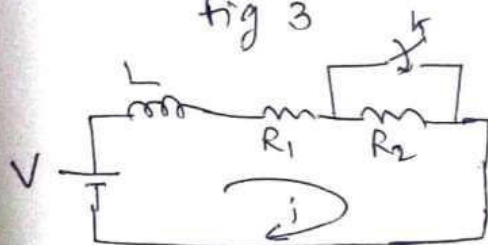


Fig 5

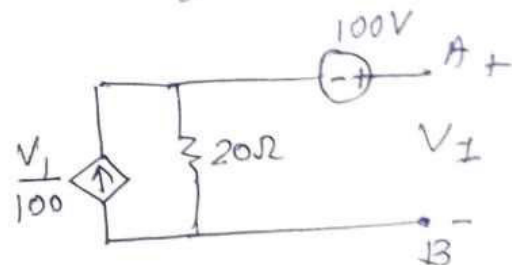


Fig 6

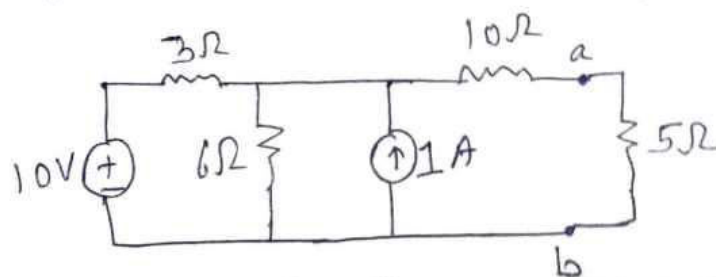


Fig 7

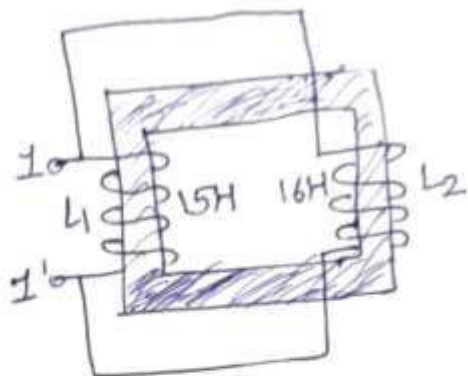


fig. 8

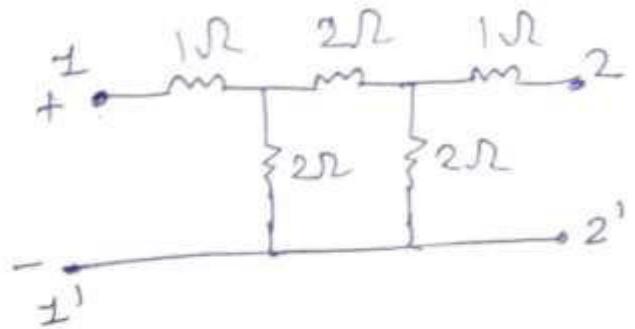


fig 9

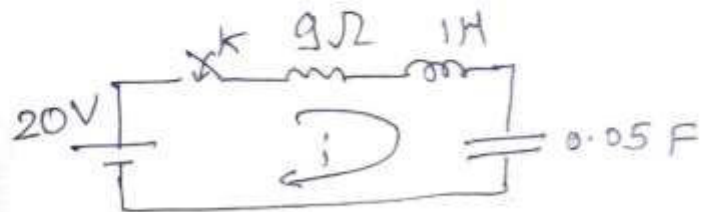


fig 10
