Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–III EXAMINATION – WINTER 2025

Subject Code:3131103 Date:22-12-2025

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)**	State and explain superposition's theorem.	**03**
	(b)	Derive the condition for network to be reciprocal for y-parameters.	**04**
	(c)	Determine the power delivered by the voltage source for the circuit shown in fig.1	**07**
Q.2	**(a)**	Determine the Laplace transform of $f(t)= e^{5t}\sin 8t$.	**03**
	(b)	Write a short note on Dot Convention.	**04**
	(c)	Derive relationship between incidence matrix and fundamental cut-set matrix.	**07**
		OR	
	(c)	Find the current in 10ohm resistor in the network of Fig.2 using Thevenin's theorem. Resistances are in ohms.	**07**
Q.3	**(a)**	Explain initial value theorem of Laplace transform.	**03**
	(b)	Explain and derive the step response to R-L series circuit using Laplace Transformation method.	**04**
	(c)	In the network of Fig.3, a steady state is reached with the switch k open. At t=0, the switch is closed. For the elements given, determine values of $V_a(0-)$ and $V_a(0+)$.	**07**
		OR	
Q.3	**(a)**	Explain final value theorem of Laplace transform.	**03**
	(b)	Explain and derive the step response to R-C series circuit using Laplace Transformation method.	**04**
	(c)	In the network of Fig.4, the switch k is closed at t=0. Find the particular solution for the current.	**07**
Q.4	**(a)**	Explain characteristic of an ideal current source.	**03**
	(b)	Briefly explain Positive Real Function (PRF).	**04**
	(c)	In the circuit shown in Fig.5, switch k is closed on position 1 at t=0, and then moved to position 2 after 0.5ms. Obtain the equations for the current in both intervals.	**07**
		OR	
Q.4	**(a)**	Explain characteristic of an ideal voltage source.	**03**
	(b)	Explain following terms: (a) Tree (b) Mesh (c) Subgraph d) Planar Graph.	**04**
	(c)	Obtain required condition for ABCD parameters to be reciprocal and symmetrical.	**07**
Q.5	**(a)**	Write a short note on Source Transformation.	**03**
	(b)	Write a short note on Inverse Hybrid Parameters.	**04**
	(c)	Obtain Z parameters for the network shown in Fig.6	**07**
		OR	
Q.5	**(a)**	What is network synthesis?	**03**
	(b)	Derive formulae to convert given y – parameters into z - parameters.	**04**
	(c)	Find Norton's equivalent network across terminals AB of the network shown in Fig. 7	**07**

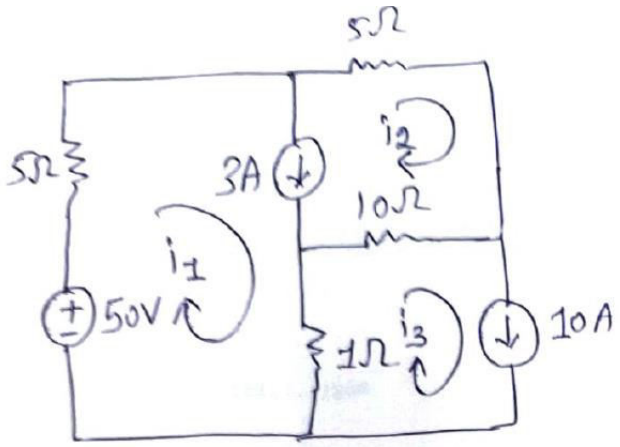


Fig 1.

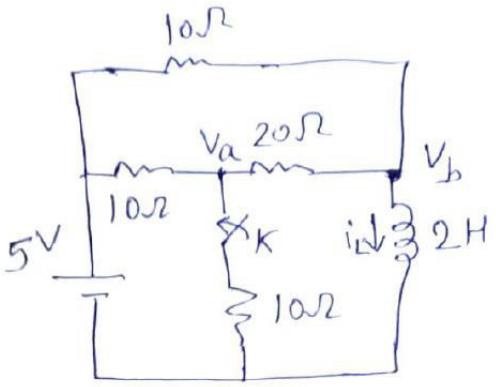


Fig 3

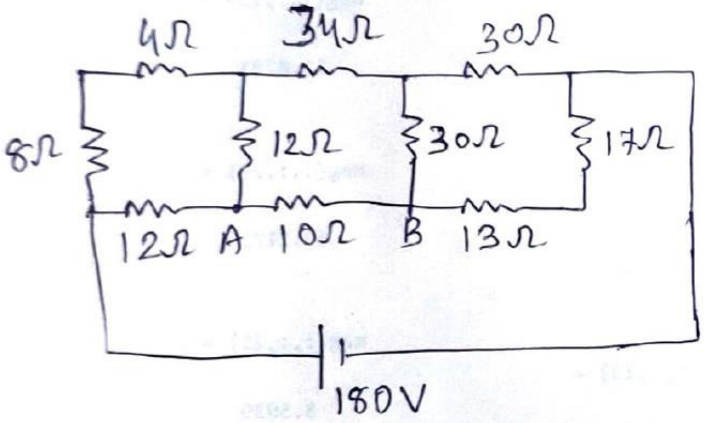


Fig 2.

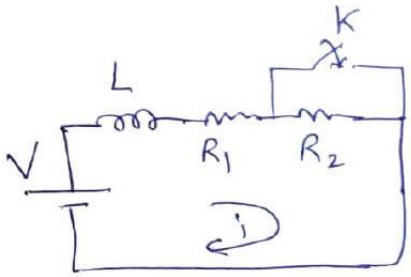


Fig 4

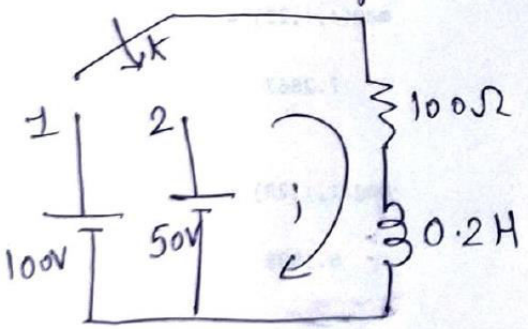


Fig 5

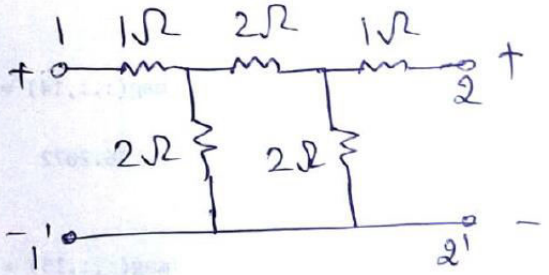


Fig 6

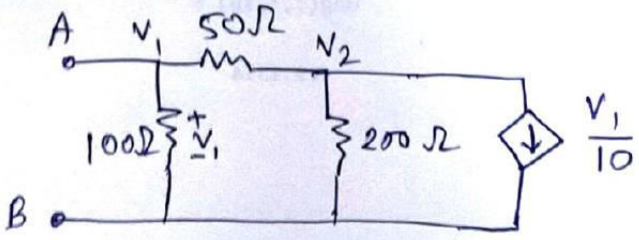


Fig 7

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–III (NEW) EXAMINATION – WINTER 2024

Subject Code: 3131103 **Date:10-12-2024**

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)**	Define (1) Tie set (2) Cut set (3) Incident Matrix	**03**
	(b)	Discuss why (a)The current in inductor cannot change instantaneously (b)The voltage across capacitor cannot change instantaneously.	**04**
	(c)	In the network of fig 1, use node analysis to determine i_x.	**07**
Q.2	**(a)**	State and Explain Reciprocity theorem.	**03**
	(b)	State and Explain initial value and final value theorem with suitable example.	**04**
	(c)	Use superposition theorem to find to value of 'v' across 20Ω resistor in the network of fig 2.	**07**
		OR	
	(c)	Find the current in 10Ω resistor in the network of fig 3 using Thevenin's theorem. Resistances are in ohms.	**07**
Q.3	**(a)**	What is time constant? What is its significance? Illustrate through an example.	**03**
	(b)	In the network of fig 4, the switch k is closed at t=0, a steady state having previously been attained. Find the particular solution for the current.	**04**
	(c)	Find a network of fig 5, switch k is opened at t=0. Determine the particular solution for v(t).	**07**
		OR	
Q.3	**(a)**	What is equivalent circuit of the charged and uncharged inductor and capacitor at t=0+ and t=∞.	**03**
	(b)	In a series R-L-C network of fig 6, switch k is closed at time t=0. Determine the particular solution of i(t) for the element values given : V=10V, R=2Ω, L=1H, C=0.2F.	**04**
	(c)	In the network of fig 7, the switch k is open and the network reaches a steady state. At t=0 switch k is closed. Find the current in the inductor fot t=0.	**07**
Q.4	**(a)**	State and Explain initial and final value theorem in term of Laplace Transformation.	**03**
	(b)	Obtain step response to R-L series circuit using Laplace Transformation.	**04**

(c) The network shown in fig 8 is in steady state with switch k is closed. At t=0 the switch is opened. Determine V_k (0+), dV_k / dt (0+). **07**

OR

Q.4 **(a)** List advantages of Laplace transformation method over classical method **03**

(b) Find the Laplace transform of the signal $f(t)=e^{-at}\sin(wt)$ **04**

(c) The network shown in fig 9 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 Va(0-) and Va(0+). **07**

Q.5 **(a)** List out the necessary and sufficient conditions for positive real function **03**

(b) List necessary condition of two port network to be Reciprocal and Symmetric in terms of Z, Y, ABCD, H parameter. **04**

(c) Derive relationship between incidence matrix (A), fundamental tie-set matrix (B_f) and fundamental cut-set matrix (Q_f). **07**

OR

Q.5 **(a)** List properties of Hurwitz polynomial. **03**

(b) Explain various interconnection of two port network. **04**

(c) Derive relation between Z-parameter and Y parameter **07**

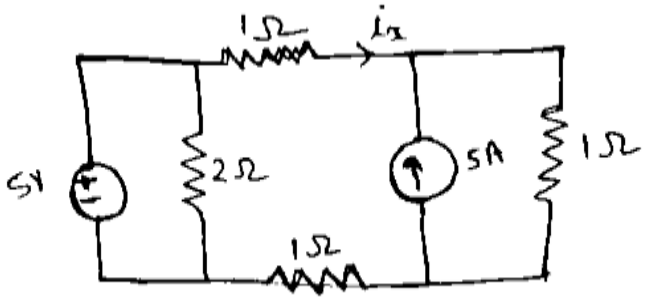


Figure - 1

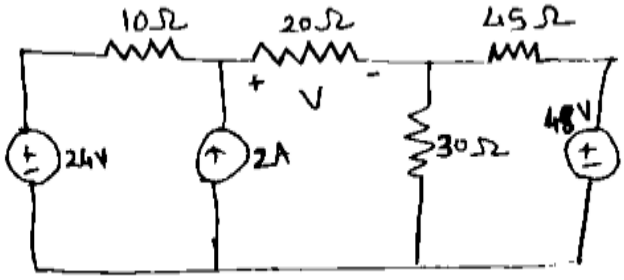


Figure - 2

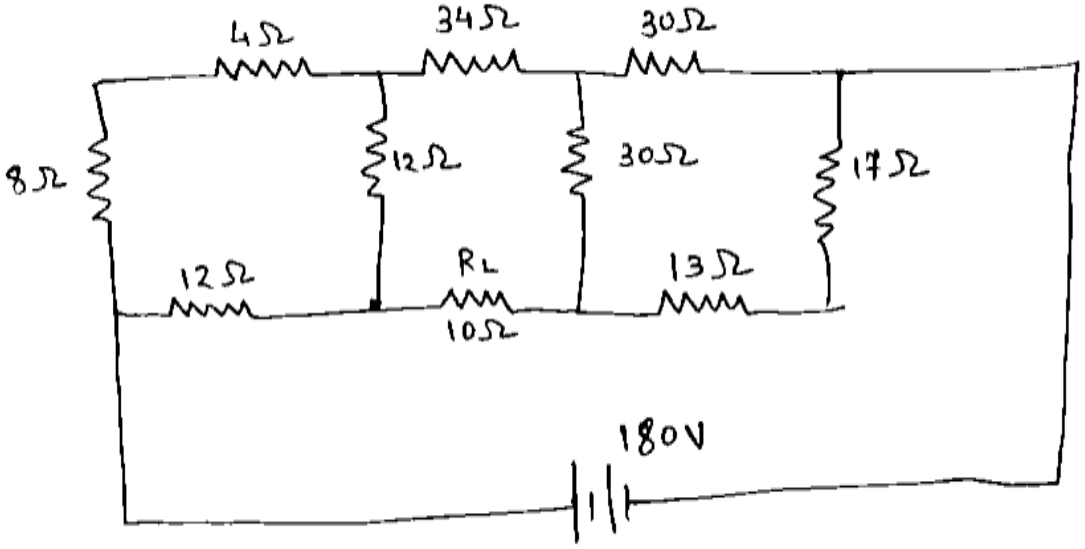


Figure - 3

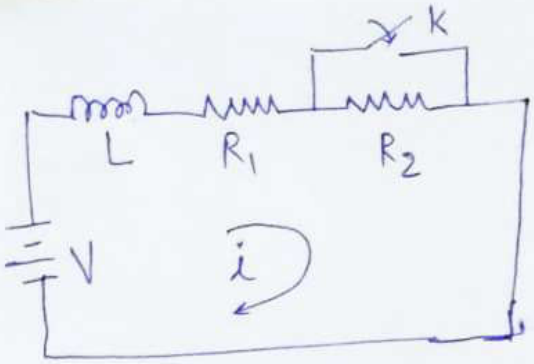


Figure · 4

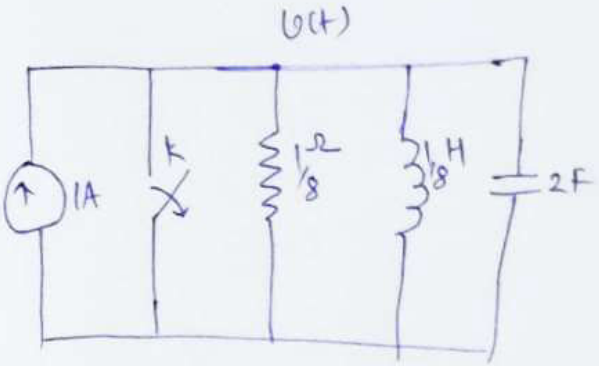


Figure · 5

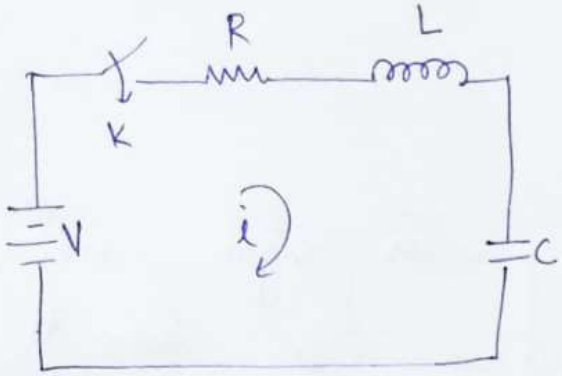


Figure · 6

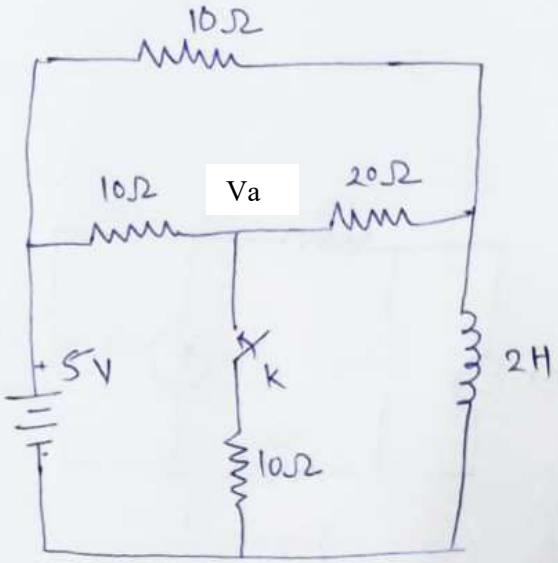


Figure · 7

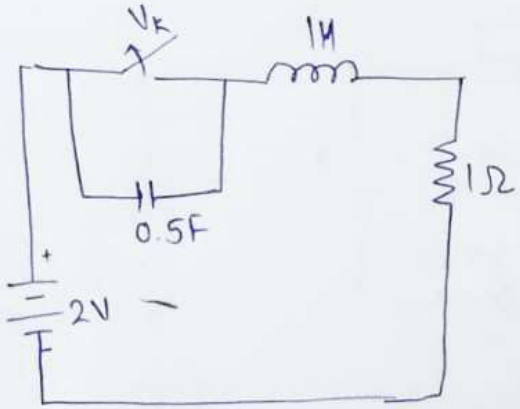


Figure · 8

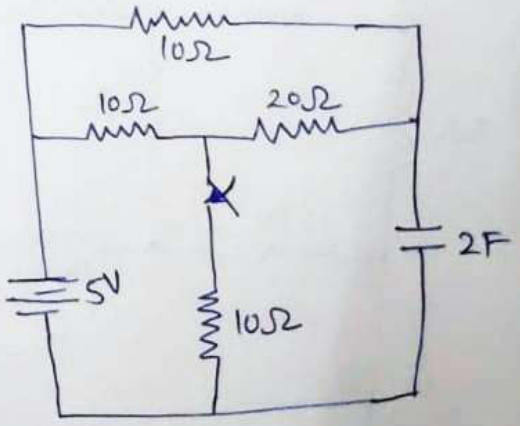


Figure 9

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – WINTER 2023

Subject Code:3131103 Date:25-01-2024

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)**	Define : Tree, Sub-graph, connected graph.	**03**
	(b)	Derive the condition for reciprocity for ABCD parameters	**04**
	(c)	For the network of Fig.1, find the unknown currents. In Fig.1 Consider the current source as 7A.	**07**
Q.2	**(a)**	Explain ideal and practical Voltage source.	**03**
	(b)	Reduce the network of Fig.2 into one equivalent current source	**04**
	(c)	Obtain Thevenin's equivalent circuit for the Fig. 3 in which R_L resistance is preserved.	**07**
		OR	
	(c)	Derive relationship between incidence matrix (A), fundamental tie-set matrix (B_f) and fundamental cut-set matrix (Q_f).	**07**
Q.3	**(a)**	Determine the Laplace transform of $f(t)= e^{-5t}\sin 8t$.	**03**
	(b)	Explain briefly PRF.	**04**
	(c)	In the network of Fig.4, a steady state is reached with switch k open.At t=0, switch is closed. Determine $v_a(0^-)$ and $v_a(0^+)$.	**07**
		OR	
Q.3	**(a)**	Explain initial value theorem of Laplace transform.	**03**
	(b)	Calculate the step response for series R-L circuit for t>0.	**04**
	(c)	In the network of Fig.5, switch k is closed at t=0. Find the particular solution for the current.	**07**
Q.4	**(a)**	What is network synthesis?	**03**
	(b)	Obtain z-parameters in terms of y-parameters.	**04**
	(c)	For the network of Fig.6, determine the h-parameters.	**07**
		OR	
Q.4	**(a)**	State and explain maximum power transfer theorem.	**03**
	(b)	State and explain the superposition theorem using suitable example.	**04**
	(c)	Obtain the particular solution for current i(t) in the circuit of Fig.7 when switch k is closed at t=0.	**07**
Q.5	**(a)**	Explain active and passive network.	**03**
	(b)	What is time constant? What is its significance?	**04**
	(c)	In Fig.8, obtain current i(t) when switch is moved from position 'a' to position 'b' at t=0.	**07**
		OR	
Q.5	**(a)**	Explain Lumped and distributed network.	**03**
	(b)	Obtain step response for R-C series circuit.	**04**

(c) In Fig.9, obtain current i(t) when switch is moved from position 'a' to position 'b' at t=0. **07**

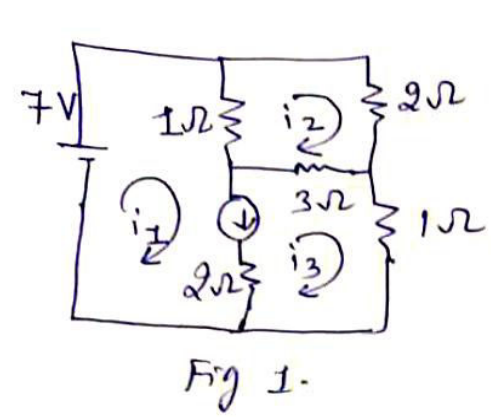


Fig 1.

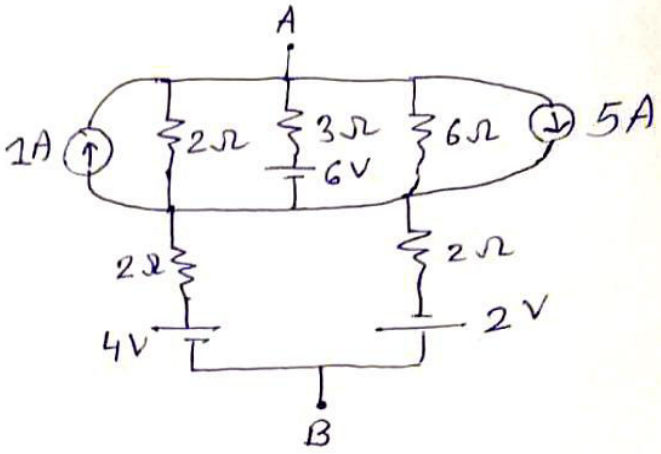


Fig 2.

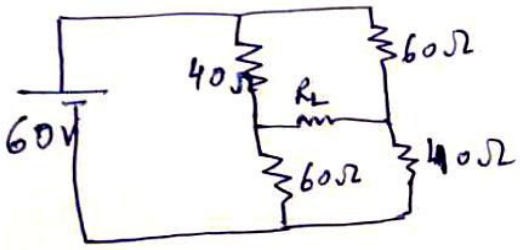


Fig 3.

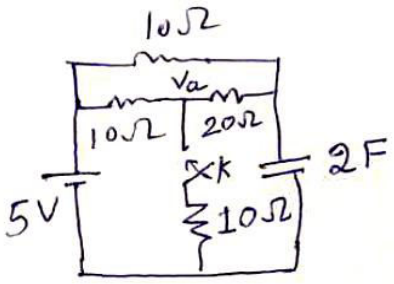


Fig 4.

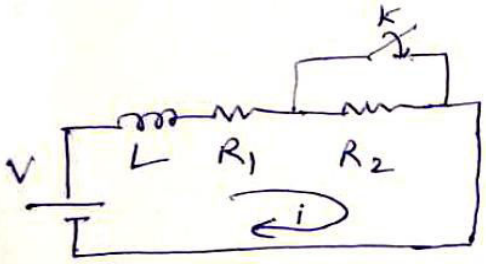


Fig 5.

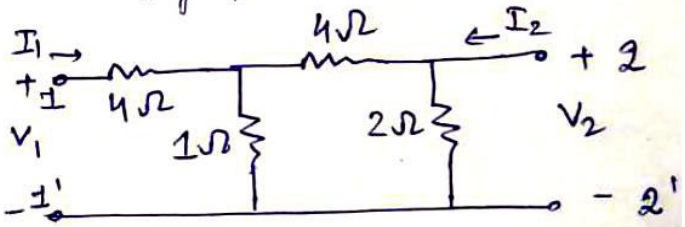


Fig 6.

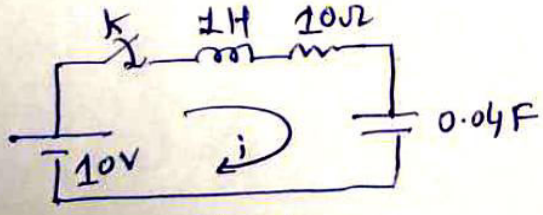


Fig 7.

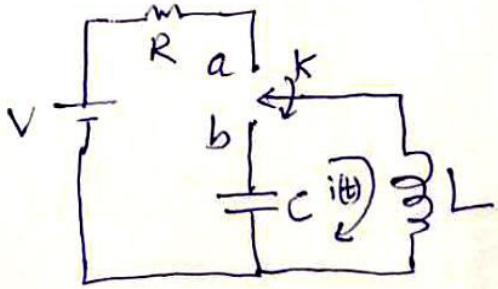


Fig 8.

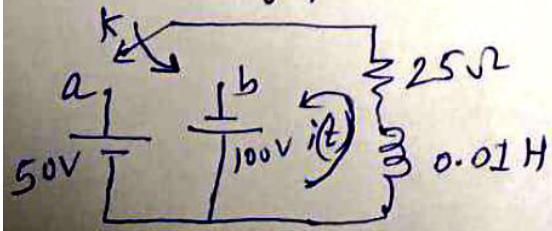


Fig 9

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III(NEW) EXAMINATION – WINTER 2022

Subject Code:3131103 Date:27-02-2023

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)**	Differentiate between an open circuit and a short circuit. Draw their characteristics in v-i plane.	**03**
	(b)	Discuss the following: (1) Linear and Non-Linear elements (2) Bilateral and Unilateral elements (3) Active and Passive elements (4) Lumped and Distributed Networks.	**04**
	(c)	The figure:1 shows three windings on a magnetic core. Using different shaped dots, establish polarity markings for the windings, and write KVL equations for this network.	**07**
Q.2	**(a)**	How many types of controlled sources are possible? Draw their symbols.	**03**
	(b)	How are ideal current and voltage sources defined? Show the conversion of a voltage source into a current source and vice versa.	**04**
	(c)	Find the current I_1 and I_2 in the network of figure:2 using mesh analysis.	**07**
		OR	
	(c)	In the network of figure:3, use node analysis to determine $\boldsymbol{i_x}$.	**07**
Q.3	**(a)**	How the following elements will behave at t=0 and t=∞. (1) Resistance (2) Inductor (3) Capacitor.	**03**
	(b)	An exponential voltage $v(t) = 4\,e^{-5t}$ is applied at time t=0 to a series R-C circuit having R= 0.2Ω and C=1F. Obtain current $i(t)$ through the circuit.	**04**
	(c)	Explain how to obtain the transient response of a first order system using an appropriate example.	**07**
		OR	
Q.3	**(a)**	What is time constant? What is its significance?	**03**
	(b)	Define the terms critical resistance, damping ratio, natural frequency and settling time for a series R-L-C circuit.	**04**
	(c)	In the network of figure:4, a steady state is reached with the switch k open. At t=0, the switch is closed. Find the voltage across capacitor for t>0.	**07**
Q.4	**(a)**	Obtain Laplace transform of (1) Unit Step function (2) Unit Ramp function (3) Unit Impulse function.	**03**
	(b)	State (1) Millman's theorem (2) Maximum Power Theorem.	**04**
	(c)	State and explain maximum power transfer theorem. Also derive the condition for maximum power transfer to the load for DC and AC circuit.	**07**
		OR	
Q.4	**(a)**	Obtain Laplace transform of $(1)u(t-a)(2)\,r(t-a)(3)\delta(t-a)$.	**03**

(b) State (1) Reciprocity Theorem (2) Superposition's theorem. **04**

(c) Find the Norton's equivalent circuit at the terminals A-B of the circuit shown in figure:5. **07**

Q.5 **(a)** Define (1) Graph (2) Cut –set (3) incidence matrix. **03**

(b) Test whether the following polynomial is Hurwitz or not : $s^3 + 4s^2 + 5s + 2$. **.04**

(c) (1) Determine y-parameters in terms of h-parameters. **07**
(2) Determine z-parameters in terms of h-parameters.

OR

Q.5 **(a)** Define (1) Oriented graph (2) Tieset matrix (3) Node. **03**

(b) Determine the range of values of 'K' so that the polynomial $P(s) = s^3 + 3s^2 + 2s + K$ is Hurwitz. **04**

(c) (1) Determine h-parameters in terms of z-parameters. **07**
(2) Determine h-parameters in terms of y-parameters.

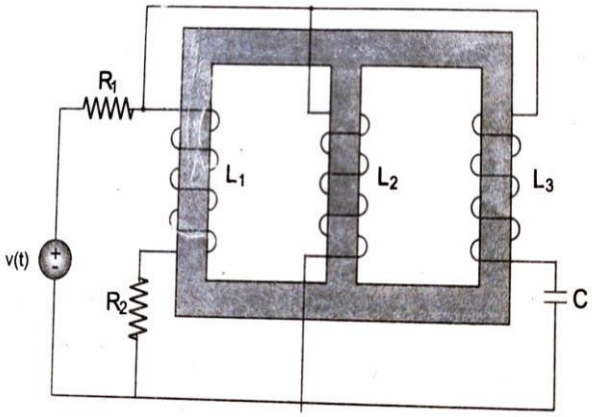


Figure:1

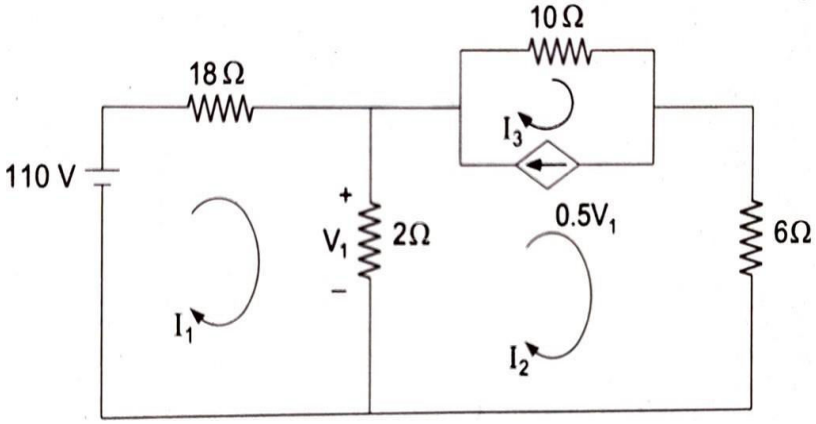


Figure:2

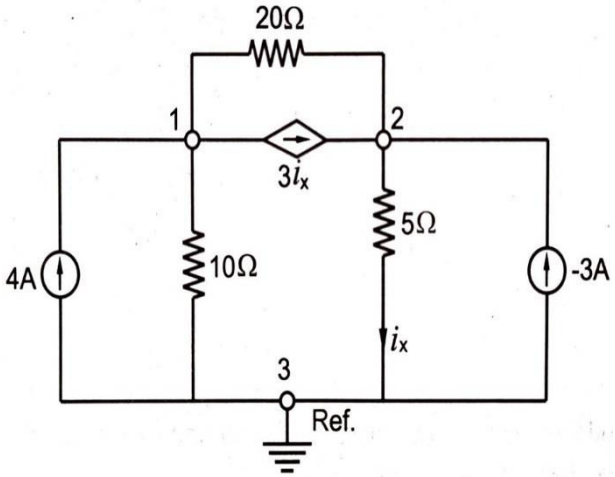


Figure:3

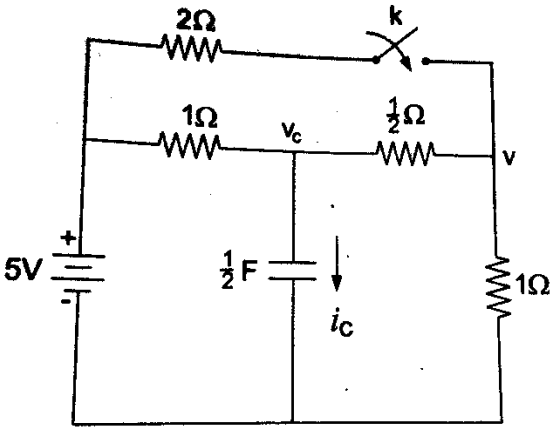


Figure:4

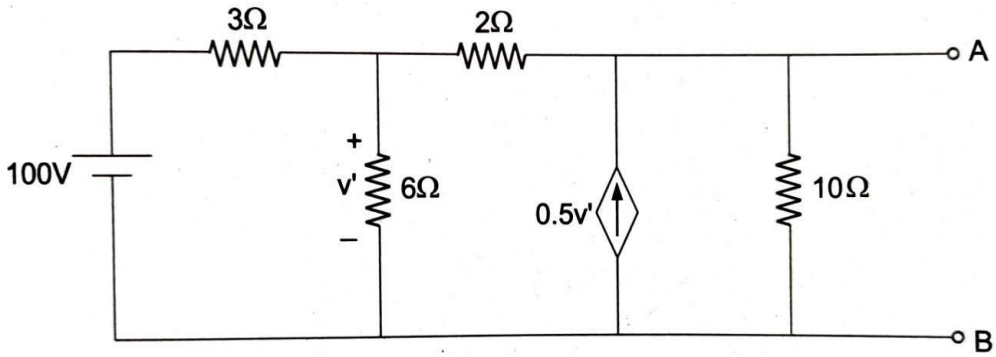


Figure:5