Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - III EXAMINATION - WINTER 2025

Subject Code: BE03000161 **Date: 15-12-2025**

Subject Name: Network Theory

Time: 10:30 AM TO 01:00 PM **Total Marks: 70**

Instructions

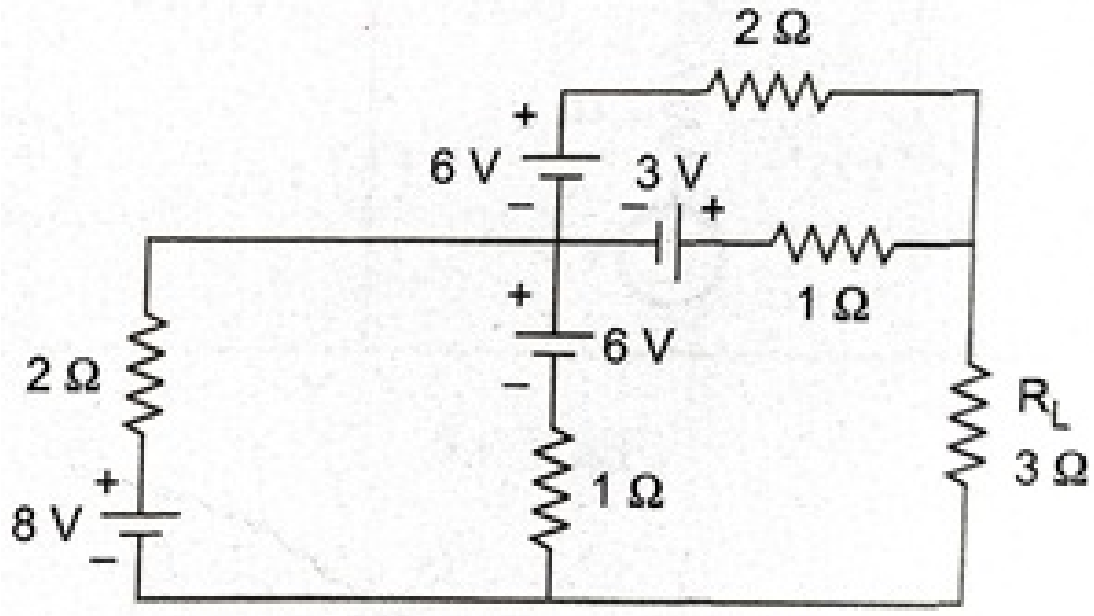
1. Attempt all questions.

2. Make suitable assumptions wherever necessary.

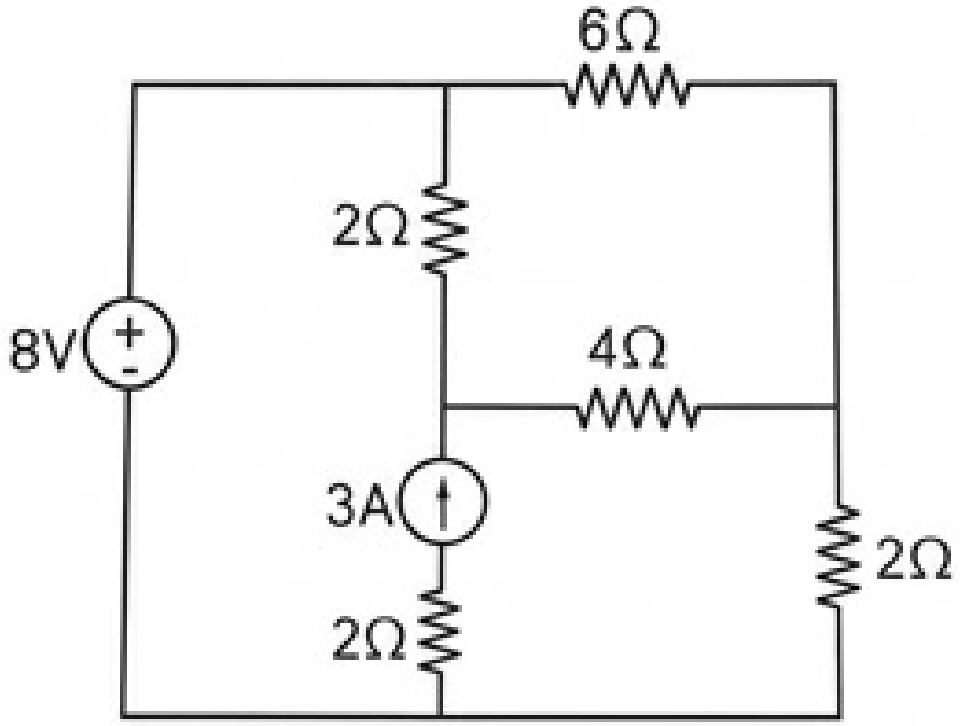
3. Figures to the right indicate full marks.

4. Simple and non-programmable scientific calculators are allowed.

			Marks
Q.1	**(a)**	List out independent and dependent electrical sources with their symbols.	**03**
	(b)	Determine the current through load resistor using source transformation techniques.	**04**

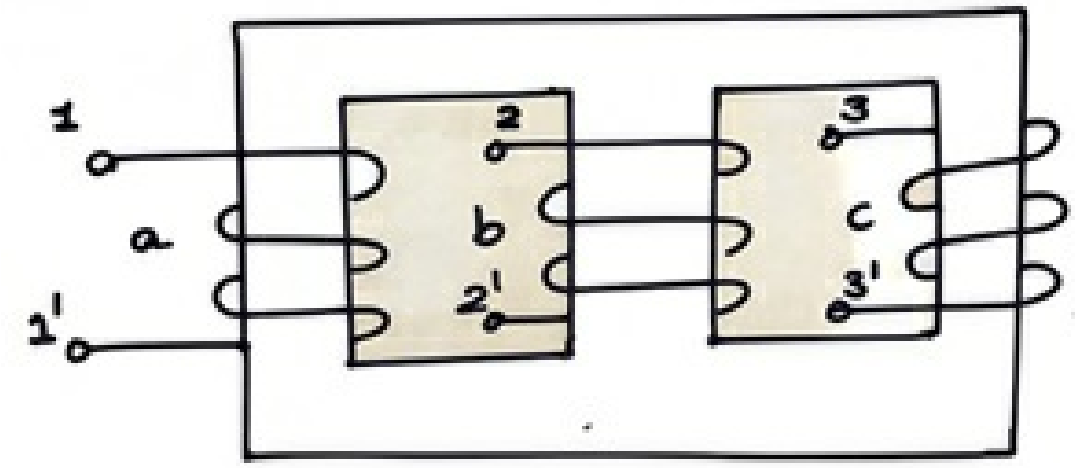


(c) For the given network, determine the current in 4Ω resistors using Mesh Analysis. **07**

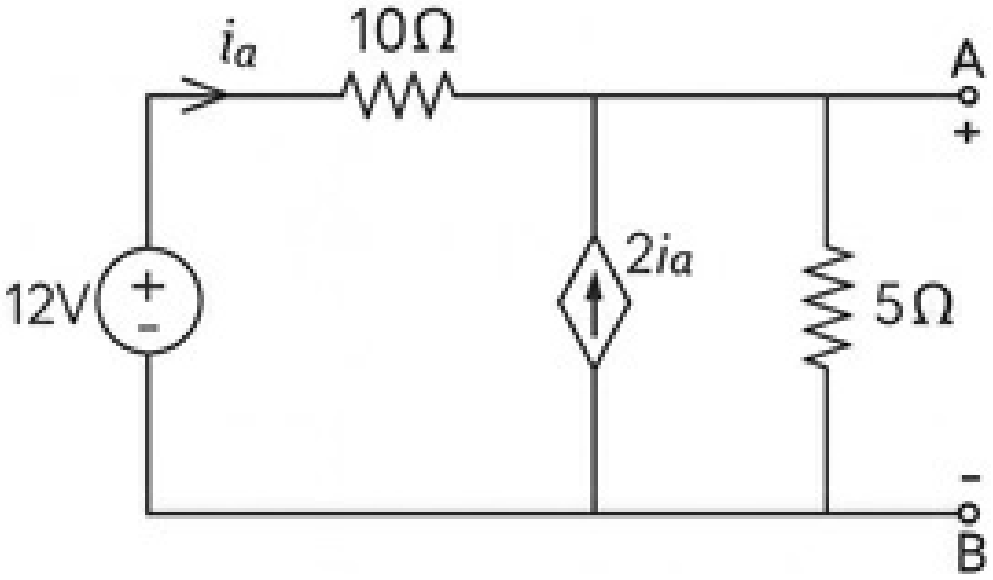


Q.2 (a) State the Superposition Theorem. List its limitations. **03**

(b) For the transformer shown in the figure with 3 winding with their winding directions over the limbs, mark the dots on the terminals according Dot convention theorem. **04**

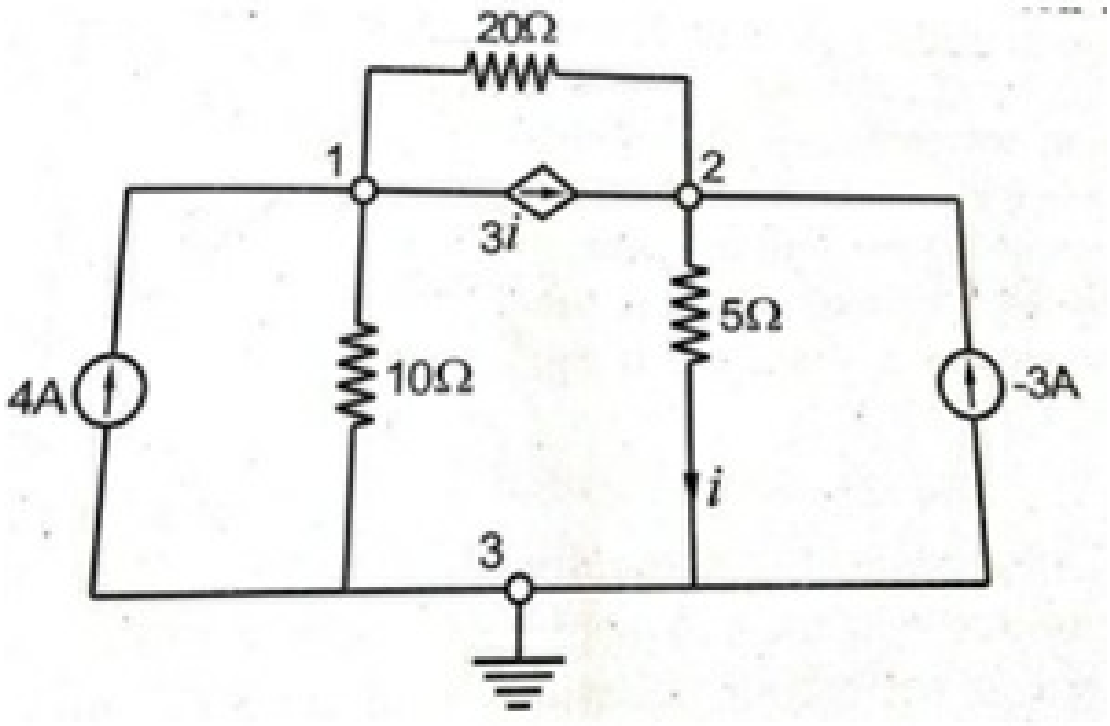


(c) Draw Thevenin's equivalent circuit across terminal AB of the given network. **07**

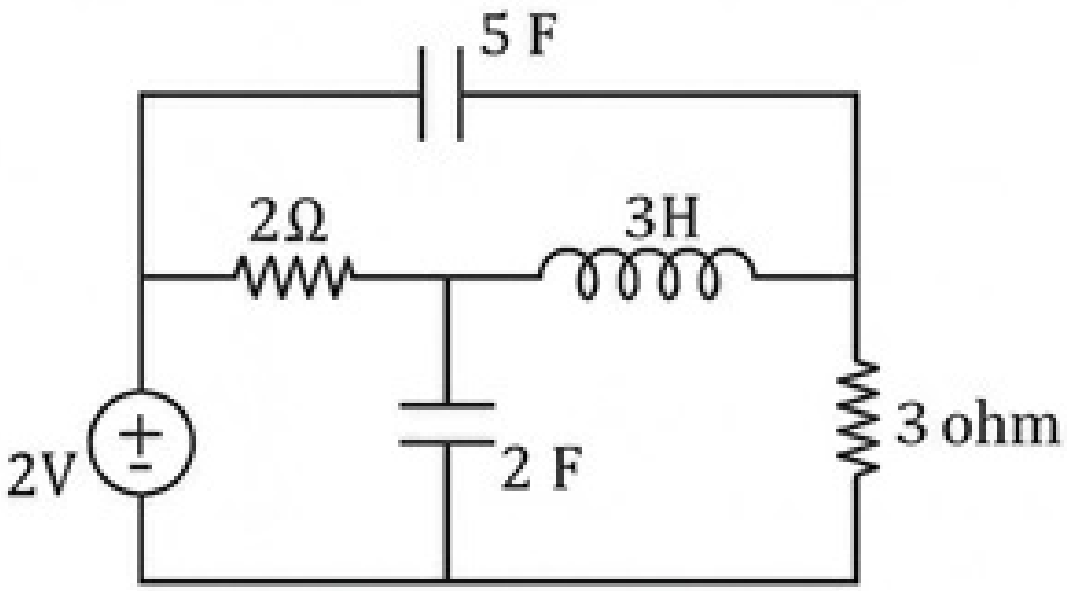


OR

(c) Determine the current i in the circuit shown in figure using Nodal analysis. **07**



Q.3 **(a)** Draw dual of the given network. **03**



(b) Draw and explain briefly the equivalent circuit of the charged and uncharged inductor and capacitor at t=0+ and t=∞(infinity). **04**

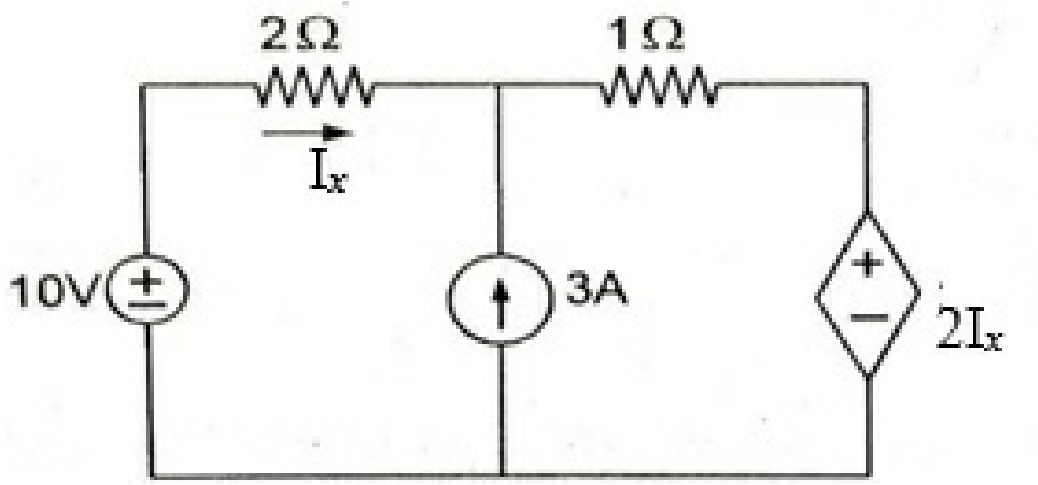
(c) State Maximum Power Transfer theorem and explain in brief. Derive the condition for maximum power transfer to the load for DC and AC circuits. **07**

OR

(a) Define the time-constant. Explain the significance of the time-constant. **03**

(b) State and Explain Millman's theorem. **04**

(c) Find the value of I_X using Superposition theorem in the circuit shown below. **07**



Q.4 **(a)** Find the Laplace Transform of $e^{-at}\cos wt$. **03**

(b) The reduced incidence matrix of an oriented graph is as shown below. **04**

$$A = \begin{pmatrix} 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{pmatrix}$$

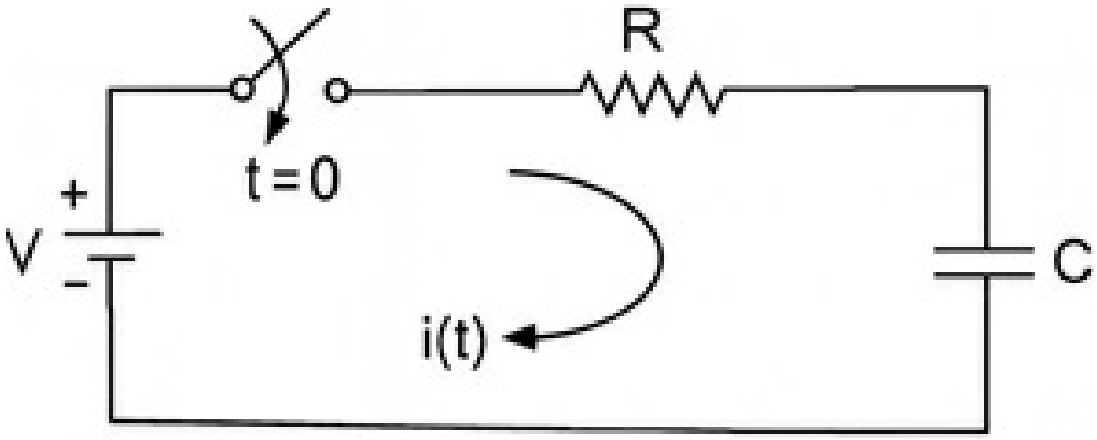
a) Draw the graph b) How many trees are possible? c) Write the tie set matrix d) Write the cut set matrix

(c) Obtain the transient response of a first order system using a suitable example. **07**

OR

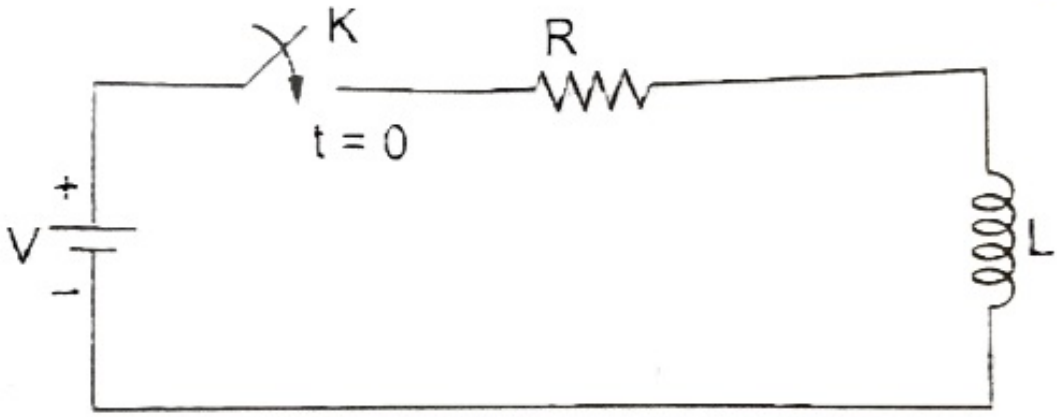
(a) State initial and final value theorem with appropriate equation in term of Laplace Transformation. **03**

(b) A series R-C circuit is connected to a constant d.c. voltage source V through switch K, as shown in figure. Initially the switch is kept open for very long time. Obtain the expression for the current $i_c(t)$ through capacitor for t>0. **04**



(c) **07**

The switch is closed at t=0. Find out value of $i, \frac{di}{dt}, \frac{d^2i}{dt^2}$ at t=0+. The value of R is 10Ω, L is 1H and 100V is applied. Assume initial current of inductor to be zero.



Q.5 **(a)** List out and write the equation of h-parameters and ABCD-parameters. **03**

(b) Derive z-parameters in terms of y-parameters. **04**

(c) Explain condition of reciprocity and symmetry of two port network in terms of z-parameter. **07**

OR

(a) Define (1) Oriented Graph (2) Incidence matrix (3) Tree **03**

(b) Write down the necessary and sufficient conditions for positive real function (PRF). **04**

(c) Derive the relation between incidence matrix, fundamental tie-set matrix and fundamental cut-set matrix. **07**

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