Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – WINTER 2021

Subject Code:3131103 **Date:23-02-2022**

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 the following : (1) Oriented Graph (2) Tie-Set (3) Incidence Matrix.	03
	(b)	Discuss the following: (1) Linear and Nonlinear Network (2) Bilateral and Unilateral Network (3) Active and Passive Network (4) Lumped and Distributed Network.	04
	(c)	Using source transformation, find the Voltage V_x in the figure:1.	07
Q.2	(a)	Obtain Laplace transform of the following functions: (1) Unit Step Function (2) Unit Ramp Function (3) Unit Impulse Function.	03
	(b)	Solve for the response $y(t)$ in the following integrodifferential equation> $$\frac{dy}{dt} + 5y(t) + 6\int_0^t y(\tau)d\tau = u(t), \qquad y(0) = 2$$	04
	(c)	For the circuit of figure:2, compute the voltage across each current source using nodal analysis.	07
		OR	
	(c)	Determine v_3 in the circuit of figure:3 using mesh analysis.	07
Q.3	(a)	A parallel RLC circuit has $L = 2\ H$ and $C = 0.25\ F$. Find the value of R that will produce unity damping factor.	03
	(b)	For the source free series RC circuit, $$v(t) = 56\,e^{-200t}\ V, \quad t > 0$$ $$i(t) = 8\,e^{-200t}\ mA, \quad t > 0$$ (1) Find the value of R and C. (2) Calculate the time constant τ.	04
	(c)	At $t = 0.15\ s$ in the circuit of figure: 4, find the value of (1) i_L (2) i_1 (3) i_2.	07
		OR	
Q.3	(a)	Consider a parallel RLC circuit having an inductance of 10mH and a capacitance of 100 μF. Determine the resistor values that would lead to overdamped and underdamped responses.	03
	(b)	In a source free series RL circuit, find the numerical value of the ratio: (1) $i(2\tau)/i(\tau)$ (2) $i(0.5\tau)/i(0)$ (3) t/τ if $i(t)/i(0) = 0.2$ (4) t/τ if $i(0) - i(t) = i(0)\ln 2$.	04
	(c)	After being open for a long time, the switch in figure:5 closes at $t = 0$. Find (1) $i_L(0^-)$ (2) $v_C(0^-)$ (3) $i_R(0^+)$ (4) $i_C(0^+)$.	07
Q.4	(a)	Find Laplace transform of $\cosh at$.	03
	(b)	Find the Norton's equivalent with respect to terminals $a - b$ in the circuit shown in figure: 6.	04
	(c)	Determine the value of R_L that will draw the maximum power from the rest of the circuit of figure: 7. Calculate the maximum power.	07
		OR	
Q.4	(a)	Find the inverse Laplace Transform of : $F(s) = 1 + \frac{3}{s+4} - \frac{5s}{s^2+25}$	03
	(b)	Determine R_{Th} and V_{Th} at terminals 1-2 for the circuit of figure: 8.	04

	(c)	Use superposition to solve for v_x in the circuit of figure: 9	**07**
Q.5	**(a)**	For the resistive network shown in the figure : 10, draw the oriented graph and tree.	**03**
	(b)	Test whether $P(s)$ is Hurwitz $P(s) = s^4 + 3s^3 + 4s^2 + 3s + 1$ using Routh's Criterion.	**04**
	(c)	Determine the hybrid parameters for the network in figure: 11.	**07**

OR

Q.5	**(a)**	For the resistive network shown in the figure: 10, Develop the incidence matrix A.	**03**
	(b)	Test whether $P(s)$ is Hurwitz $P(s) = s^8 + 5s^6 + 2s^4 + 3s^2 + 1$ using Routh's Criterion.	**04**
	(c)	Obtain the $y-$ parameters for the circuit in figure: 12	**07**

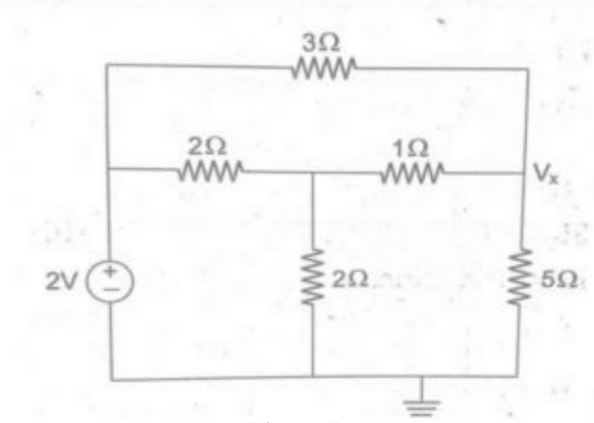

Figure:1

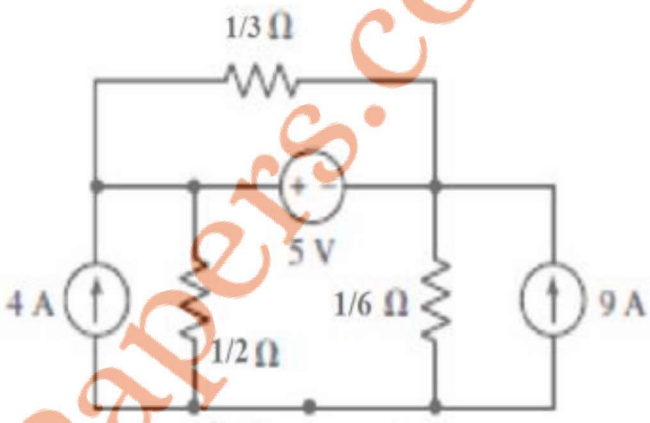

Figure: 2

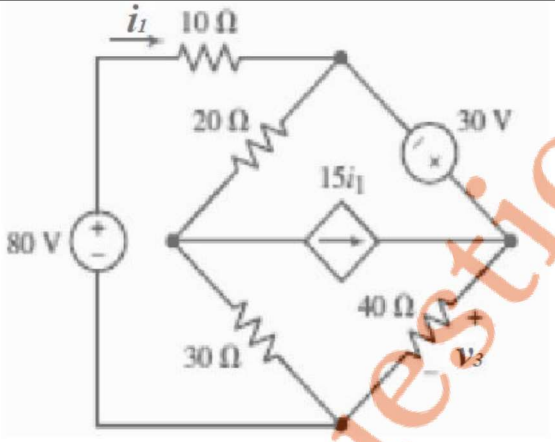

Figure: 3

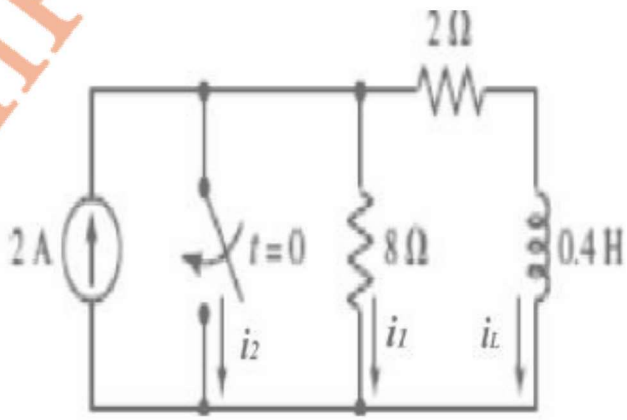

Figure:4

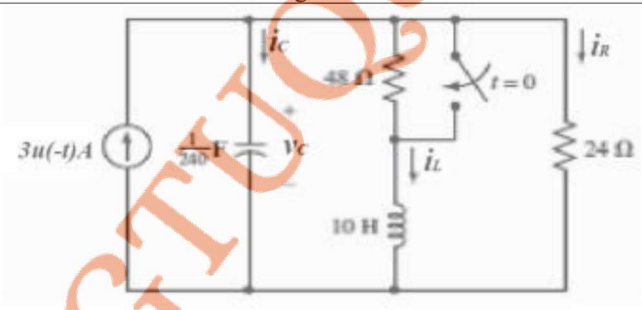

Figure:5

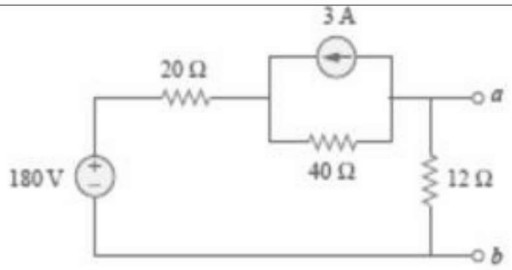

Figure: 6

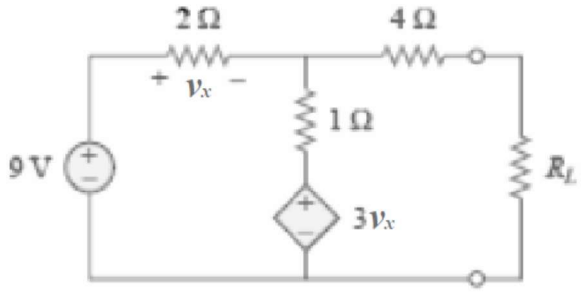

Figure: 7

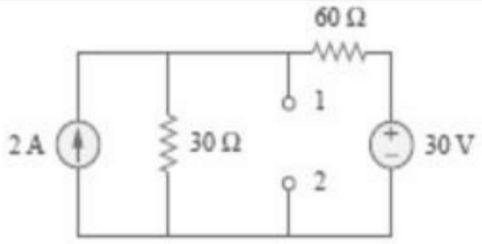

Figure: 8

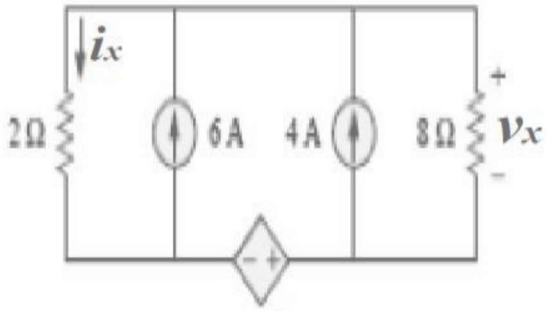

Figure:9

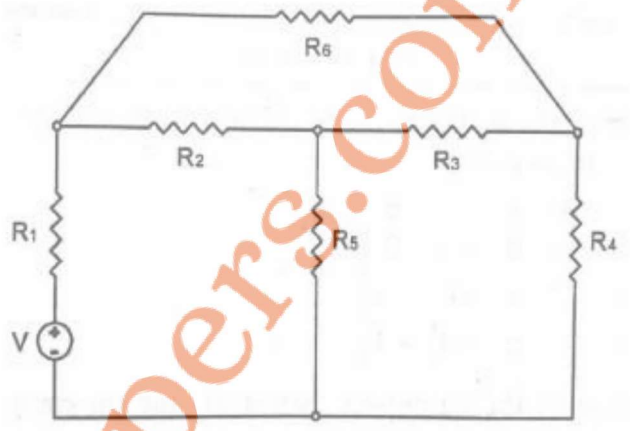

Figure:10

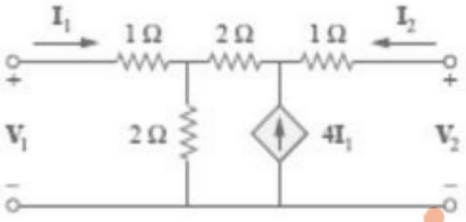

Figure: 11

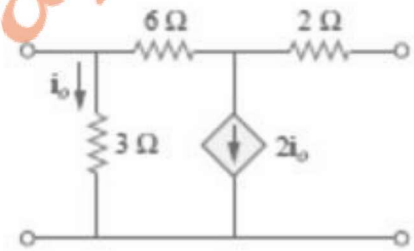

Figure: 12

****