Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III (New) EXAMINATION – WINTER 2019

Subject Code: 2130901 **Date: 28/11/2019**

Subject Name: Circuits and Networks

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.**

Q.1	**(a)**	In terms of two terminal elements, define: 1) Unilateral elements, 2) Passive elements, 3) Time-variant elements.	**03**
	(b)	Draw circuit representations of ideal and practical voltage and current sources. How internal impedance affects the performance of practical voltage and current sources?	**04**
	(c)	For the network shown in figure 1, obtain the power loss in 4Ω and 5Ω resistors using mesh analysis.	**07**
Q.2	**(a)**	Using equivalent circuit representations at t=0+, explain initial conditions in R, L and C elements.	**03**
	(b)	For the network shown in figure 1, obtain the power loss in 10Ω resistor using nodal analysis.	**04**
	(c)	Find out Z-parameters for the network of figure 2	**07**
		OR	
	(c)	Find out ABCD parameters for the network of figure 3.	**07**
Q.3	**(a)**	State and explain substitution theorem.	**03**
	(b)	For the network shown in figure 4, switch K is closed at t=0. The current waveform is observed with CRO. The initial value of the current is measured to be 0.01 A. The transient appears to disappear in 0.1 sec. Find: 1) The value of R, 2) The value of C, 3) The equation of i(t).	**04**
	(c)	For the network given in figure 5, obtain equivalent circuit and hence find current in the branch AB using Thevenin's theorem.	**07**
		OR	
Q.3	**(a)**	Give various properties of positive real functions.	**03**
	(b)	State and explain compensation theorem.	**04**
	(c)	In the network of figure 6, capacitor C_1 is charged to voltage V_0 and the switch is closed at t=0. When R_1=2MΩ, V_0=1000V, R_2=1MΩ, C_1=10μF and C_2=20μF, solve for d^2i_2/dt^2 at t=0+.	**07**
Q.4	**(a)**	Draw general nature of time response of a system when: 1) Poles are complex conjugate having negative real part. 2) Poles are imaginary with zero real part. Give your comment on the two responses.	**03**
	(b)	Explain the properties of Hurwitz polynomial.	**04**
	(c)	RL series circuit with R=25Ω and L=5H is connected to V=100V dc supply at time t=0. With no initial current in inductor, find: 1) Equation for circuit current i(t) 2) equations for voltage across R and L 3) Current in circuit at t=0.5sec 4) Time 't' at which voltages across R and L become same.	**07**
		OR	
Q.4	**(a)**	What are poles and zeroes of network functions? Explain their physical significance.	**03**

(b) State the advantages of network analysis using Laplace transformation. List out steps of obtaining solution of differential equation using Laplace transformation. **04**

(c) For a second order circuit, explain solution of non-homogeneous differential equations, clearly indicating all steps involved. Describe in detail, how particular integral can be evaluated using method of undetermined coefficients. **07**

Q.5 **(a)** Describe in brief, how solution of second order homogeneous differential equations can be obtained. **03**

(b) For the network shown in figure 7, without changing the node numbers, branch numbers and direction of branches shown in figure, obtain the reduced incidence matrix considering node 5 as the reference node. **04**

(c) In the circuit of figure 8, switch is moved to position 2 after being in position 1 for a very long time. Using Laplace transformation, obtain expression for i(t) for t>0. **07**

OR

Q.5 **(a)** Find the driving-point impedance for the network shown in figure 9. Arrange the polynomials with the highest-ordered term normalized to unity coefficient. **03**

(b) Draw the oriented graph from the reduced incidence matrix of the graph given as: **04**

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

(c) For the network shown in figure 7, without changing the node numbers, branch numbers and direction of branches shown in figure, obtain the tie-set and fundamental cut-set matrices considering the tree formed with branches 1, 2, 3 and 4 as the twigs of the tree. **07**

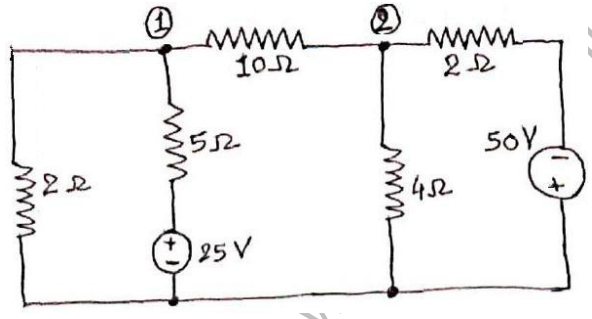

Figure 1

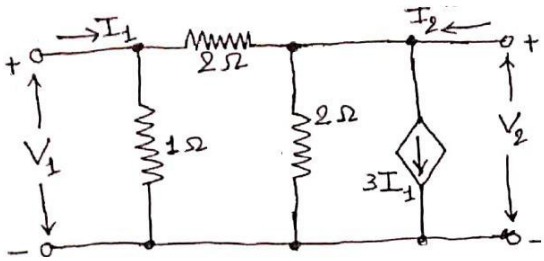

Figure 2

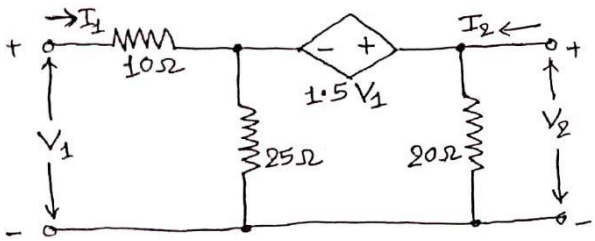

Figure 3

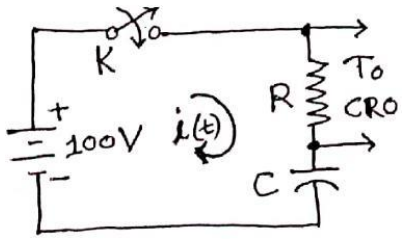

Figure 4

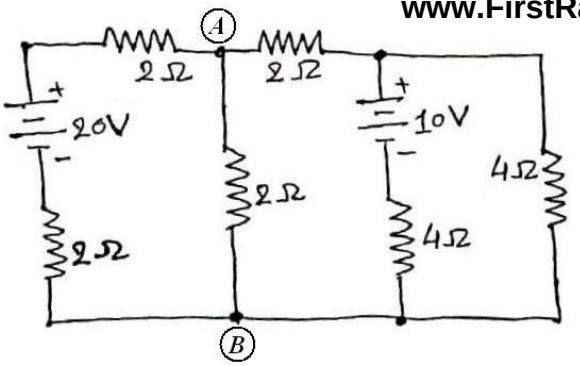

Figure 5

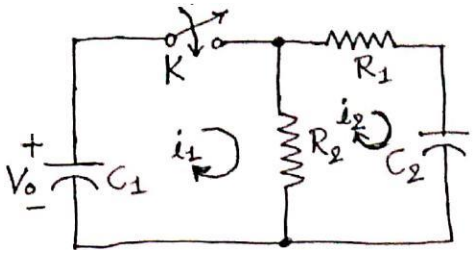

Figure 6

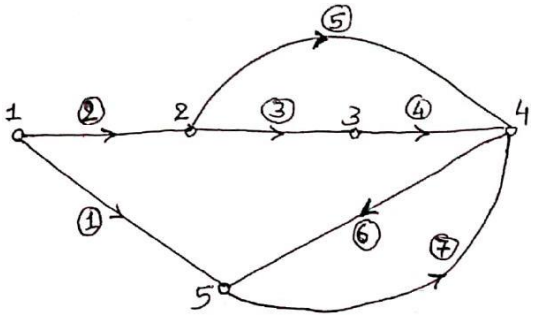

Figure 7

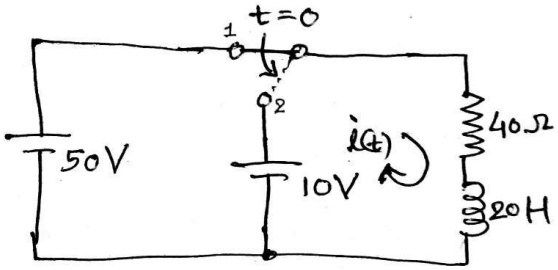

Figure 8

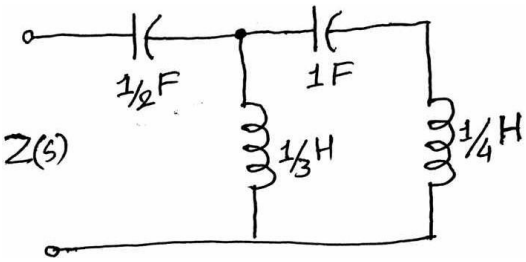

Figure 9

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