GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–III(NEW) EXAMINATION – SUMMER 2023

Subject Code:3130906   **Date:26-07-2023**
Subject Name:Electrical Circuit Analysis
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)**	Enlighten the interpretation of "j" operator.	**03**
	(b)	What do you mean by Unbalanced load? Derive the current equations for	**04**
		(i) unbalanced three wire star connected load	
		(ii) (ii) Unbalanced delta connected load.	
	(c)	Calculate the voltage across 5Ω resistor using mesh analysis for a **figure.1**.	**07**
Q.2	**(a)**	Explain the concept of duality and derive the dual network for series RLC circuit shown in **figure.2.**	**03**
	(b)	State and Explain the super position theorem using suitable example.	**04**
	(c)	Calculate the unknown node voltages V_1,V_2 and V_3 shown in **figure.3**, using node analysis.	**07**

<div align="center">OR</div>

	(c)	A Wheatstone bridge shown in **figure.4** ABCD is arranged as follows: AB = 10Ω, BC = 30Ω, CD = 15Ω and DA = 20Ω. A 2V battery of internal resistance 2Ω is connected between points A and C with A being positive. A galvanometer of resistance 40Ω is connected between B and D. Find the magnitude and direction of the galvanometer current as per given branch currents.	**07**
Q.3	**(a)**	Prepare the table for equivalent branch of final conditions for R,L,C.	**03**
	(b)	For a given **figure.5** find out the $i_1(0+)$ and $i_L(0+)$, the network has been achieve the steady state at t<0.	**04**
	(c)	In the circuit shown in **figure.6**, a 10 volt d.c.supply is suddenly applied to series circuit. The capacitor is initially uncharged. Obtain the particular solution for the current i(t) in the circuit.	**07**

<div align="center">OR</div>

Q.3	**(a)**	Prepare the table for equivalent branch of initial conditions for R,L,C.	**03**
	(b)	In the network shown in **figure.7**, K is closed at t = 0 with zero current in the inductor. Find the values $i,\dfrac{di}{dt}$,at t=0+,for R=8Ω and L=	**04**
	(c)	In the network shown in **figure.8**, a steady state is reached with switch k open. At t=0 switch k closed find out the i(t) for the given numerical values and sketch the current transient.	**07**

Q.4 **(a)** Give the importance of poles and zeros.   **03**

(b) Elaborate the zero radian frequency and zero Neper frequency.   **04**

(c) For a given **figure.9** inductor current and capacitor voltage is zero at t=0-,so for a given network show that its generated current transform is   **07**

$$I(S) = \frac{10(s^2+s+1)}{(s^2+1)(s^2+2s+1)}$$

OR

Q.4 **(a)** Make a table for the transfer impedances for R,L and C.   **03**

(b) Calculate the step response for series R-C circuit for t>0   **04**

(c) In the network shown in **figure.10** calculate the current i(t) ,when $i_1(t)=7e^{-6t}$ A for t≥0, i(0) =0, also find out i(∞) using Laplace transforms.   **07**

Q.5 **(a)** Derive the condition for reciprocity for z-parameters.   **03**

(b) Derive relationship of z-Parameter in terms of ABCD Parameter   **04**

(c) For the network shown in **figure.11** calculate the y parameters.   **07**

OR

Q.5 **(a)** Derive the condition for reciprocity for ABCD parameters.   **03**

(b) Derive relationship of ABCD Parameter in terms of y-Parameters   **04**

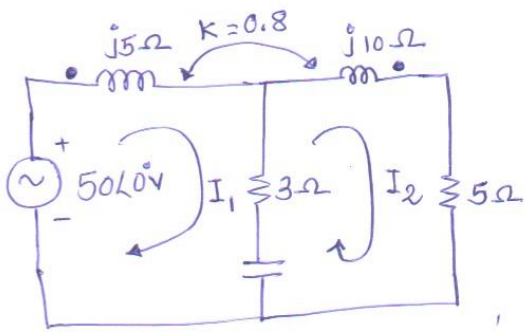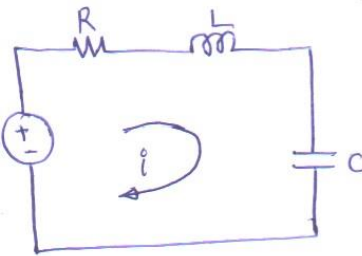**(c)** For the network shown in **figure.12** calculate the h- parameters.   **07**

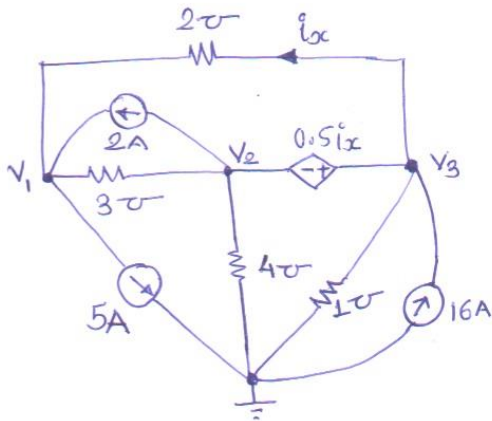## Figure. 1

j5Ω K=0.8 j10Ω

$50\angle 0^\circ V$ I_1 3Ω I_2 5Ω $V(t)$

Figure-2

R L C

$V(t)$ i

Figure. 3.

2℧ i_x

2A

V_1 V_2 $0.5i_x$ V_3

3℧

5A 4℧ 1℧ 16A

Figure. 4

10Ω 30Ω $i_x - i_g$

i_x

40Ω

i_y

20Ω i_g $i_y + i_g$ 15Ω

$i_x + i_y$ $i_x + i_y$

2Ω

i_1

2V

Figure. 5.

L=1H

2A K 1Ω 1Ω

Figure. 6

1H 10Ω

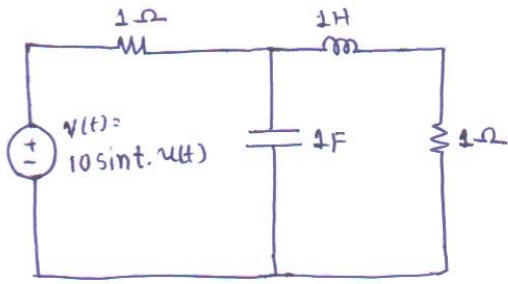10V i 0.04F

Figure. 7

8Ω

K

12V i L=0.2H

Figure. 8.

30Ω 20Ω

20V K 0.5H

10V i

P. 3/4

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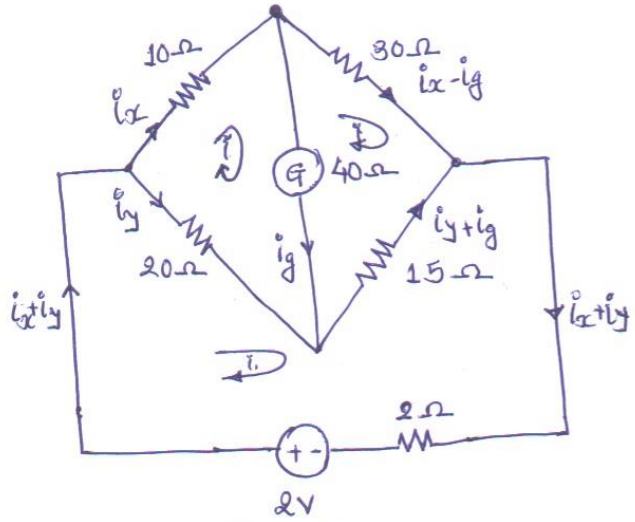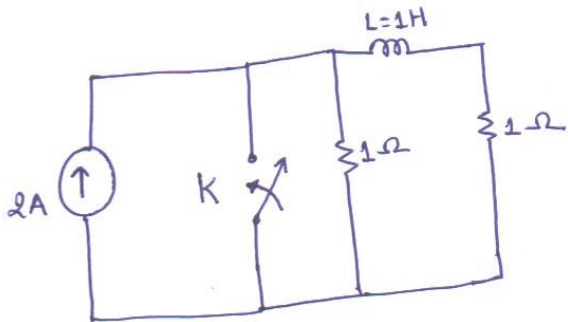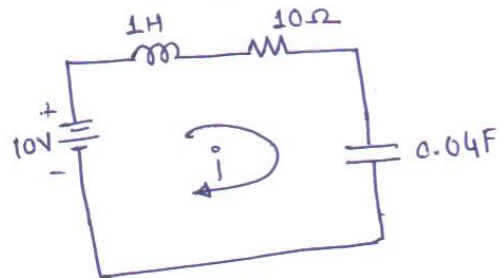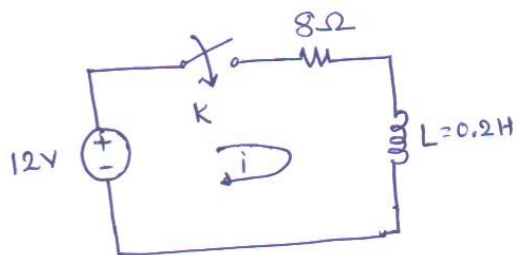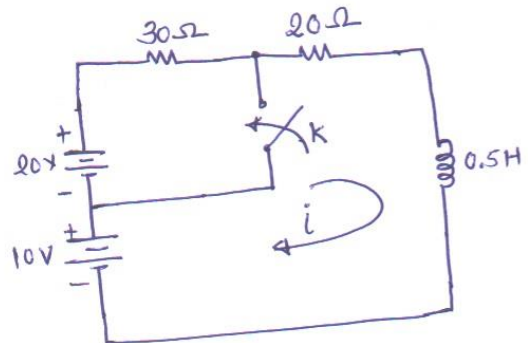
Figure. 9.

Figure. 10.

Figure. 11