

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE- SEMESTER-III EXAMINATION – WINTER 2025****Subject Code:3130906****Date:12-12-2025****Subject Name: Electrical Circuit Analysis****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**

- |            |                                                                                                                                                                                                                                                                                                                                      |           |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Q.1</b> | (a) State and explain Reciprocity theorem.                                                                                                                                                                                                                                                                                           | <b>03</b> |
|            | (b) Develop a step-by-step approach to solving electrical networks using the superposition theorem.                                                                                                                                                                                                                                  | <b>04</b> |
|            | (c) State maximum power transfer theorem and derive condition for maximum power transfer for AC circuit in which $Z_L$ is complex with variable resistance and fixed reactance.                                                                                                                                                      | <b>07</b> |
|            |                                                                                                                                                                                                                                                                                                                                      |           |
| <b>Q.2</b> | (a) Explain the time constant in the context of a series R-L and series R-C circuit.                                                                                                                                                                                                                                                 | <b>03</b> |
|            | (b) Provide an explanation of the initial condition in various passive electrical elements. In network analysis, how important are the initial conditions?                                                                                                                                                                           | <b>04</b> |
|            | (c) Determine the node voltages $V_1$ and $V_2$ in a network of Fig.1 using node analysis.                                                                                                                                                                                                                                           | <b>07</b> |
| <b>OR</b>  |                                                                                                                                                                                                                                                                                                                                      |           |
|            | (c) Find the voltage across 1 k $\Omega$ resistor in the circuit shown in Fig 2 using superposition theorem.                                                                                                                                                                                                                         | <b>07</b> |
|            |                                                                                                                                                                                                                                                                                                                                      |           |
| <b>Q.3</b> | (a) Define the term (i) RMS values (ii) Apparent power (iii) Complex power.                                                                                                                                                                                                                                                          | <b>03</b> |
|            | (b) Explain the steps to obtain dual of a network with suitable example.                                                                                                                                                                                                                                                             | <b>04</b> |
|            | (c) Derive relationship between h-parameters and z-parameters.                                                                                                                                                                                                                                                                       | <b>07</b> |
| <b>OR</b>  |                                                                                                                                                                                                                                                                                                                                      |           |
| <b>Q.3</b> | (a) Elaborate series-series connection for two-port network.                                                                                                                                                                                                                                                                         | <b>03</b> |
|            | (b) Explain Kirchhoff Current Law and Kirchhoff Voltage Law using an appropriate example.                                                                                                                                                                                                                                            | <b>04</b> |
|            | (c) In the network shown in Fig. 3 a steady state is reached with the switch k open with $V=100V$ , $R_1=10\Omega$ , $R_2=R_3=20\Omega$ , $L=1\text{ H}$ and $C=1\mu F$ . At time $t=0$ , the switch is closed. Determine<br>(i) Voltage across C before the switch is closed and the polarity.<br>(ii) $i_1$ and $i_2$ at $t=0^+$ . | <b>07</b> |
|            |                                                                                                                                                                                                                                                                                                                                      |           |
| <b>Q.4</b> | (a) Explain concept of Laplace transformation. What are the advantages and disadvantages of Laplace transformation?                                                                                                                                                                                                                  | <b>03</b> |
|            | (b) Explain time constant in case of series R-L and series R-C circuit.                                                                                                                                                                                                                                                              | <b>04</b> |
|            | (c) Describe the network's poles and zeros. Provide an explanation of the importance of poles and zeros in various network functions.                                                                                                                                                                                                | <b>07</b> |
| <b>OR</b>  |                                                                                                                                                                                                                                                                                                                                      |           |
| <b>Q.4</b> | (a) Why are there no simultaneous changes in the voltage in the capacitor and the current in the inductor?                                                                                                                                                                                                                           | <b>03</b> |
|            | (b) Generalize relationship of ABCD to z-parameters.                                                                                                                                                                                                                                                                                 | <b>04</b> |
|            | (c) In the network of Fig 4, the switch is closed for a long time and at $t=0$ , the switch is opened. Determine the current through the capacitor.                                                                                                                                                                                  | <b>07</b> |

- Q.5 (a) Find out symmetry condition for ABCD parameters 03  
 (b) What are the properties of Laplace transformation? Explain in detail 04  
 (c) Obtain Z-parameters for network shown in Fig.5. Draw the equivalent model. z-parameter 07

OR

- Q.5 (a) Point out the relations between voltage and current for the following elements. (1) Resistor (2) Inductor. 03  
 (b) Briefly describe h parameters for a two port network. 04  
 (c) Apply the theory of nodal analysis and find the nodal voltages  $V_1, V_2$  and  $V_3$  as shown in Fig.6. 07

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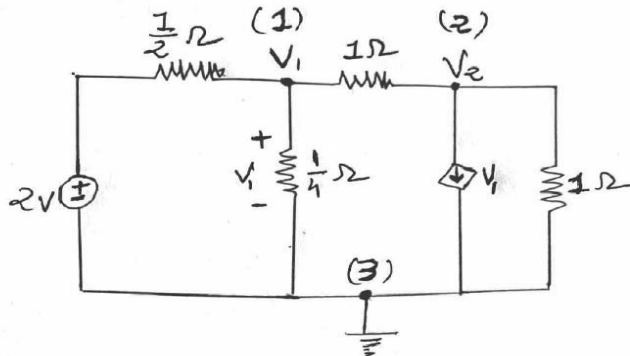


Fig. 1

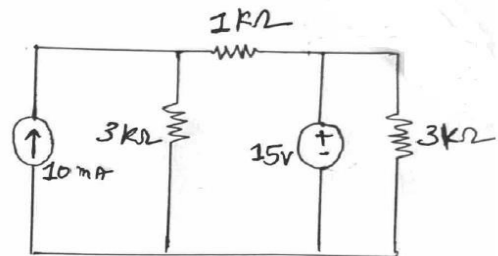


Fig. 2

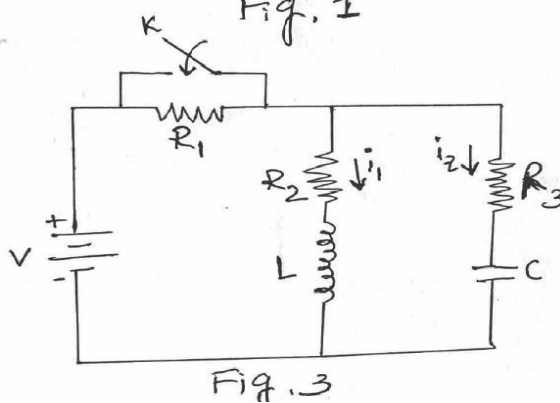


Fig. 3

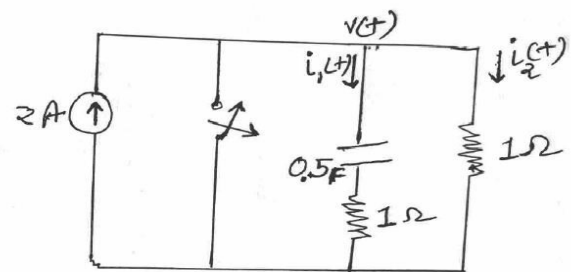


Fig. 4

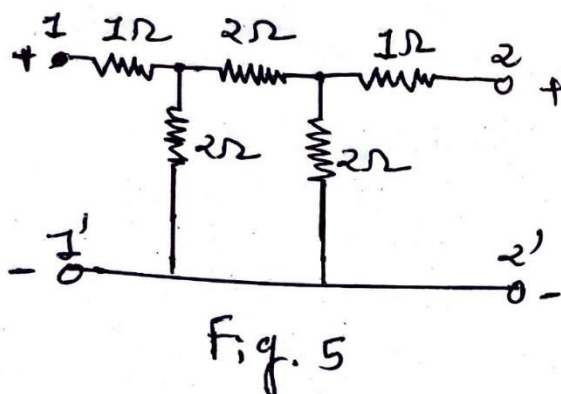


Fig. 5

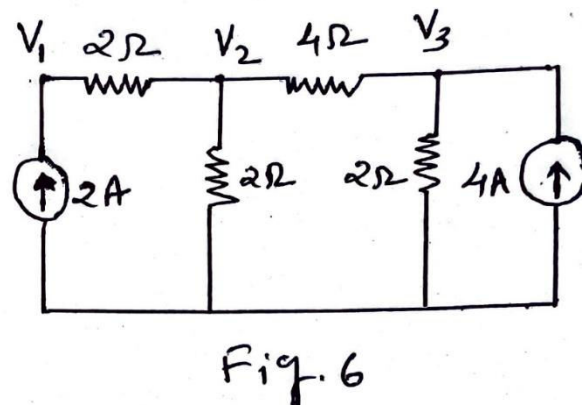


Fig. 6

Enrolment No./Seat No \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 3130906

Date: 26-11-2024

Subject Name: Electrical Circuit Analysis

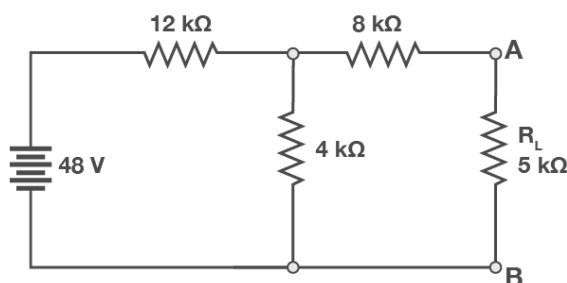
Time: 10:30 AM TO 01:00 PM

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) Explain Norton's theorem.                                        | 03    |
|     | (b) State and explain Superposition theorem.                         | 04    |
|     | (c) Determine the load current of Figure 1 using Thevenin's Theorem. | 07    |



|     |                                                                                                                                               |    |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|----|
| Q.2 | (a) Explain the initial condition in different passive electrical elements. What is the importance of initial conditions in network analysis? | 03 |
|     | (b) Formulate the step response of an R-L series circuit using the Laplace Transform method.                                                  | 04 |
|     | (c) Explain in detail about transient response in series R-C circuit having DC excitation.                                                    | 07 |

OR

|     |                                                                                                                                                      |    |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|     | (c) State and explain Maximum power transfer theorem with suitable example.                                                                          | 07 |
| Q.3 | (a) Explain the importance of Dot convention in coupled circuit with suitable example.                                                               | 03 |
|     | (b) Discuss why.<br>(i) The current in inductor cannot change instantaneously.<br>(ii) The voltage across a capacitor cannot change instantaneously. | 04 |
|     | (c) Provide a detailed explanation of an ideal transformer.                                                                                          | 07 |

OR

|     |                                                                                                                       |    |
|-----|-----------------------------------------------------------------------------------------------------------------------|----|
| Q.3 | (a) In terms of two terminal elements, define: 1) Unilateral elements, 2) Passive elements, 3) Time-variant elements. | 03 |
|-----|-----------------------------------------------------------------------------------------------------------------------|----|

|            |     |                                                                                                                     |    |
|------------|-----|---------------------------------------------------------------------------------------------------------------------|----|
|            | (b) | Define unit parabola function. Obtain Laplace transform of unit parabola function.                                  | 04 |
|            | (c) | Define poles and zeros of network function. Explain significance of poles and zeros in different network functions. | 07 |
| <b>Q.4</b> | (a) | Obtain Laplace of Hyperbolic sine and cosine functions.                                                             | 03 |
|            | (b) | Derive expression of Y parameters in terms of Z parameters.                                                         | 04 |
|            | (c) | Prove Initial and Final Value theorems.                                                                             | 07 |
| <b>OR</b>  |     |                                                                                                                     |    |
| <b>Q.4</b> | (a) | Specify the term (i) RMS values (ii) Apparent power (iii) Complex power.                                            | 03 |
|            | (b) | What is the condition of symmetry of all different two port parameters?                                             | 04 |
|            | (c) | State the Advantages of Laplace transform method over classical method.                                             | 07 |
| <b>Q.5</b> | (a) | Show that h parameters will not exist for a two port network where $Z_{22}=0$ .                                     | 03 |
|            | (b) | Describe the solution of non-homogeneous differential equation for particular integral.                             | 04 |
|            | (c) | Draw an equivalent circuit of a two port network in terms of (i) admittance parameters (ii) h- parameters.          | 07 |
| <b>OR</b>  |     |                                                                                                                     |    |
| <b>Q.5</b> | (a) | Find out reciprocity condition for h-Parameters.                                                                    | 03 |
|            | (b) | Explain characteristic of an ideal voltage source.                                                                  | 04 |
|            | (c) | Evaluate Step by step solution to solve with suitable examples for electrical networks by using Thevenin's Theorem. | 07 |

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Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3130906

Date:16-01-2024

Subject Name:Electrical Circuit Analysis

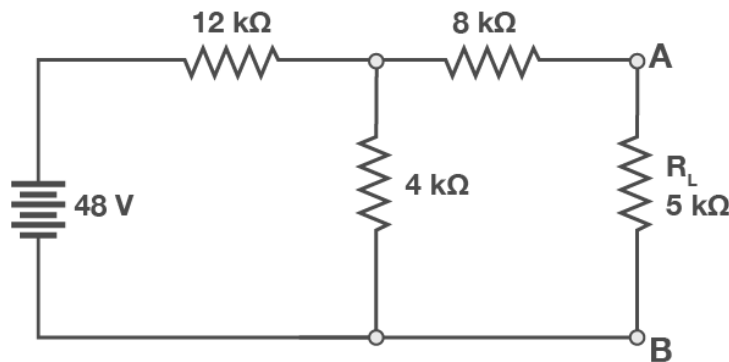
Time:10:30 AM TO 01:00 PM

Total Marks:70

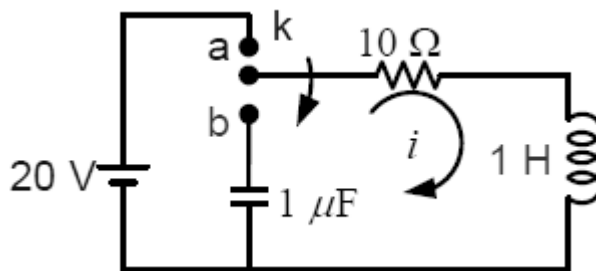
Instructions:

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.

- |            |                                                                                                | <b>Marks</b> |
|------------|------------------------------------------------------------------------------------------------|--------------|
| <b>Q.1</b> | (a) Explain Norton's theorem.                                                                  | <b>03</b>    |
|            | (b) Develop Step by step solution to solve electrical networks by using Superposition Theorem. | <b>04</b>    |
|            | (c) Determine the load current of figure 1 given below using Thevenin's Theorem.               | <b>07</b>    |

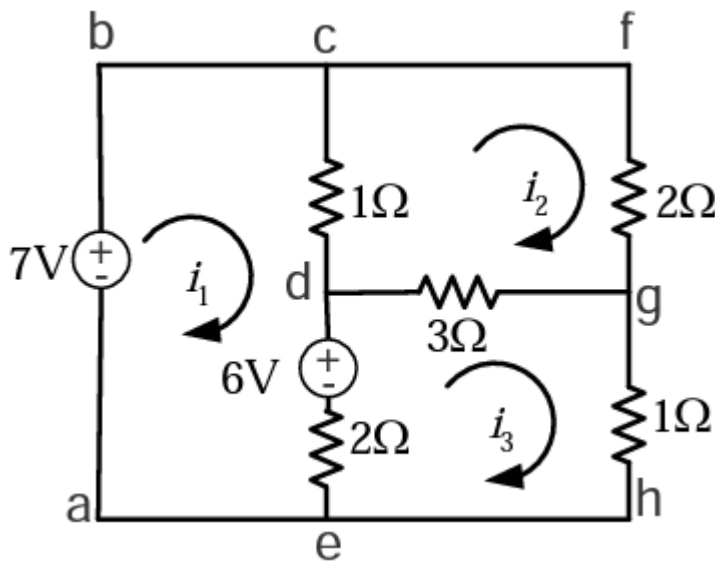


- |            |                                                                                                                                                                                                                      |           |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Q.2</b> | (a) Explain in brief about the ideal transformer.                                                                                                                                                                    | <b>03</b> |
|            | (b) Derive the step response to R-L series circuit using Laplace Transformation method.                                                                                                                              | <b>04</b> |
|            | (c) For the circuit shown in Figure 2 switch K is changed from position a to b at $t=0$ , steady state condition having been reached before switching. Find the values of $i$ ; $di/dt$ , $d^2i/dt^2$ at $t = 0^+$ . | <b>07</b> |



OR

- |     |                                                                              |           |
|-----|------------------------------------------------------------------------------|-----------|
| (c) | In the circuit shown in Figure 3 determine the mesh currents $i_1, i_2, i_3$ | <b>07</b> |
|-----|------------------------------------------------------------------------------|-----------|



- Q.3**
- (a) Explain the initial condition in different passive electrical elements. What is the importance of initial conditions in network analysis? **03**
  - (b) Discuss why. **04**
    - (i) The current in inductor cannot change instantaneously.
    - (ii) The voltage across a capacitor cannot change instantaneously.
  - (c) Prove Initial and Final Value theorems. **07**

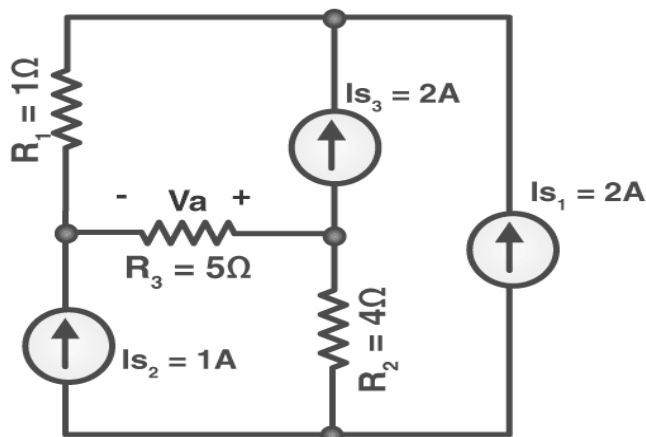
**OR**

- Q.3**
- (a) Explain the importance of Dot convention in coupled circuit with suitable example. **03**
  - (b) What are the properties of Laplace transformation? Explain in detail. **04**
  - (c) What is time constant? What is its significance? Illustrate through an example. **07**

- Q.4**
- (a) Specify the term (i) RMS values (ii) Apparent power (iii) Complex power. **03**
  - (b) Convert the capacitance  $C$  (passive element) to Laplace domain using Laplace transformation. **04**
  - (c) Define poles and zeros of network function. Explain significance of poles and zeros in different network functions. **07**

**OR**

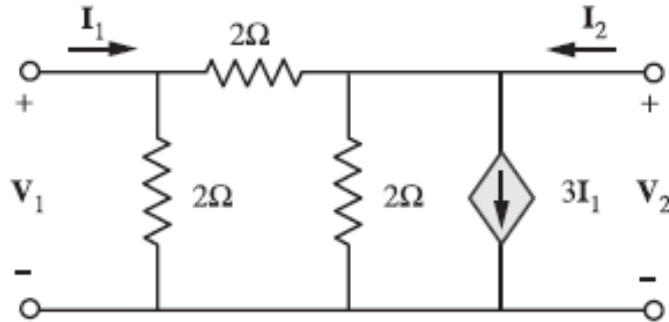
- Q.4**
- (a) Explain characteristics of unit ramp function. **03**
  - (b) Explain time constant in case of series R-L and series R-C circuit. **04**
  - (c) Find the value of voltage across  $R_3$  resistance of figure 4 using Nodal Analysis. **07**



- Q.5** (a) What is the condition of symmetry of all different two port parameters? **03**  
 (b) Generalize relationship of h-parameters to y-parameters. **04**  
 (c) Obtain ABCD parameters in terms of Z-parameters for a two-port network. **07**

**OR**

- Q.5** (a) Define H-parameter of a two-port network. **03**  
 (b) Find out reciprocity condition for h-Parameters. **04**  
 (c) Determine Y-parameters of the circuit shown in figure 5. **07**



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**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER– III(NEW) EXAMINATION – WINTER 2022****Subject Code:3130906****Date:22-02-2023****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     |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Q.1</b> | (a) State and explain Reciprocity theorem.                                                                                                                                                                  | <b>03</b> |
|            | (b) What is the significance of Maximum Power transfer theorem? State and explain with example.                                                                                                             | <b>04</b> |
|            | (c) Determine the value of the voltage across $30\Omega$ resistor using super position theorem for the network of figure-1.                                                                                 | <b>07</b> |
| <b>Q.2</b> | (a) Find the current through the resistors shown in the network of Figure-2.                                                                                                                                | <b>03</b> |
|            | (b) Determine the voltage across $4\Omega$ resistor using Thevenin theorem for the network of Figure-3.                                                                                                     | <b>04</b> |
|            | (c) Determine the node voltages for the circuit shown in Figure-4.                                                                                                                                          | <b>07</b> |
|            | <b>OR</b>                                                                                                                                                                                                   |           |
|            | (c) Determine the voltage across $4\Omega$ resistor using mesh analysis for the network of Figure-5.                                                                                                        | <b>07</b> |
| <b>Q.3</b> | (a) In the network of Figure-6, the switch k is closed at $t=0$ , a steady state having previously been attained. Find $i$ at $t=0+$ .                                                                      | <b>03</b> |
|            | (b) Explain time constant in case of series R-L and series R-C circuit.                                                                                                                                     | <b>04</b> |
|            | (c) In the network of Figure-7, a steady state is reached with the switch k open, at $t=0$ , the switch k is closed. Find $i(t)$ for the given values.                                                      | <b>07</b> |
|            | <b>OR</b>                                                                                                                                                                                                   |           |
| <b>Q.3</b> | (a) Draw the exact dual network for the network shown in Figure-8                                                                                                                                           | <b>03</b> |
|            | (b) Explain and derive the step response to R-L series circuit using Laplace Transformation method.                                                                                                         | <b>04</b> |
|            | (c) In the network of Figure-9, the switch k is open at time $t=0$ . Obtain particular solution for $v(t)$ . Assume zero initial condition.                                                                 | <b>07</b> |
| <b>Q.4</b> | (a) Define poles and zeros of network function. Explain significance of poles and zeros in different network functions.                                                                                     | <b>03</b> |
|            | (b) Determine the current flowing through the $3\Omega$ resistor using Norton theorem for the network of Figure-10.                                                                                         | <b>04</b> |
|            | (c) In a series R-L-C circuit of Figure-11 the switch k is closed at time $t=0$ . Obtain particular solution for the current using laplace transform method. Assume zero initial conditions in the element. | <b>07</b> |
|            | <b>OR</b>                                                                                                                                                                                                   |           |
| <b>Q.4</b> | (a) Point out the relations between voltage and current for the following elements. (1) Resistor (2) Inductor.                                                                                              | <b>03</b> |
|            | (b) Draw impedance triangle for R-L and R-C circuit and explain related terms.                                                                                                                              | <b>04</b> |

- (c) Three phase coils each having a resistance of  $8\Omega$  and inductance of  $0.02\text{ H}$  are connected in delta to a three phase  $480\text{V}$ ,  $50\text{Hz}$  supply. Calculate line current, phase current and power absorbed. **07**

**Q.5** (a) Determine the Y-Parameter of a two port network from the given open circuit Impedence parameters  $Z_{11} = 5\Omega$ ,  $Z_{12} = 3\Omega$ ,  $Z_{21} = 3\Omega$ ,  $Z_{22} = 4\Omega$ . **03**

(b) Derive expression of ABCD parameters in terms of Z parameters. **04**

(c) Determine Z-parameters of the circuit shown in Figure-12. **07**

**OR**

**Q.5** (a) Obtain condition for reciprocity and symmetry of a two port network in terms of Y-parameters. **03**

(b) A two port network is represented by following equations: **04**

$$V_1 = 24 I_1 + 8 I_2$$

$$V_2 = 8 I_1 + 32 I_2$$

Determine h- parameter.

(c) Determine transmission parameters of the circuit shown in Figure-13. **07**

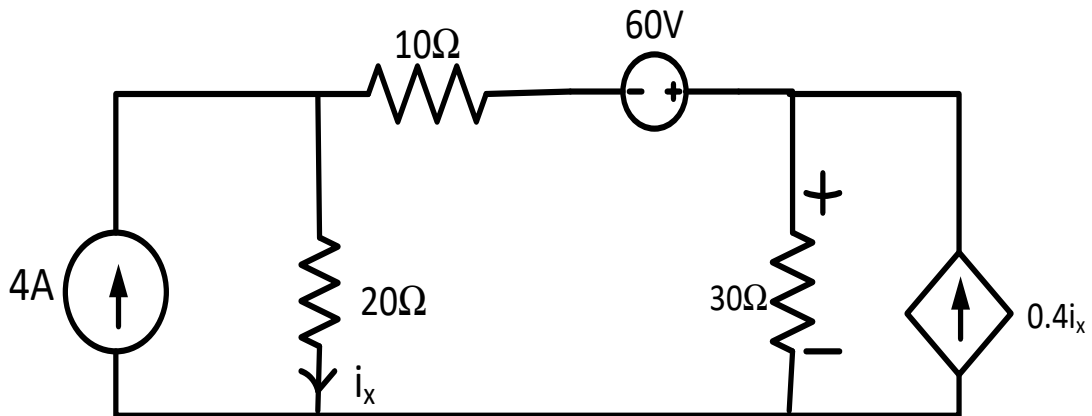


Figure-1

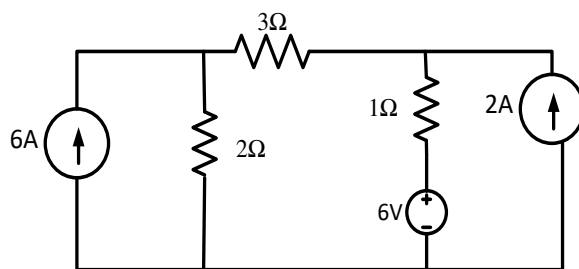


Figure-2

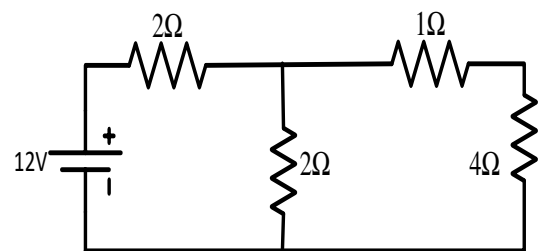


Figure-3

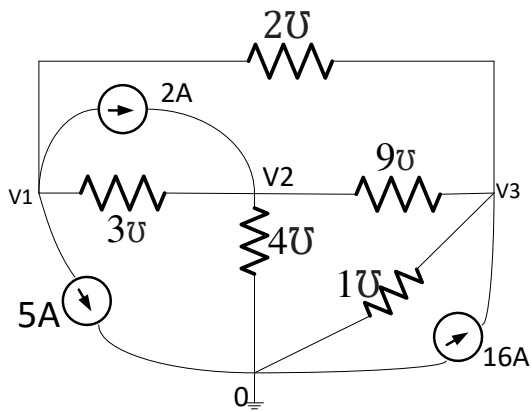


Figure-4

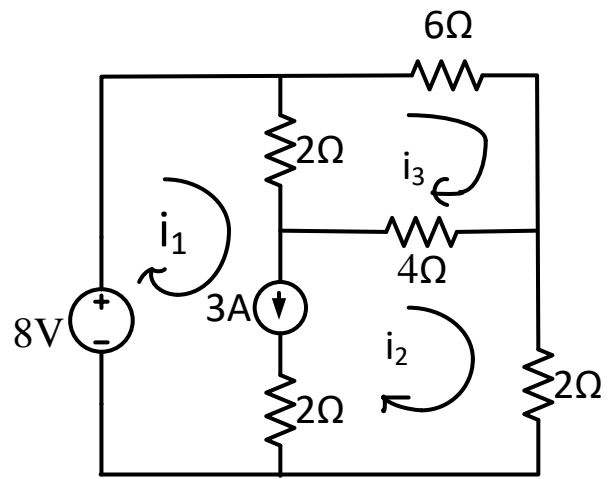


Figure-5

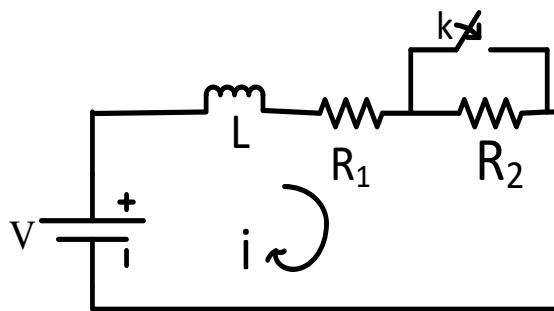


Figure-6

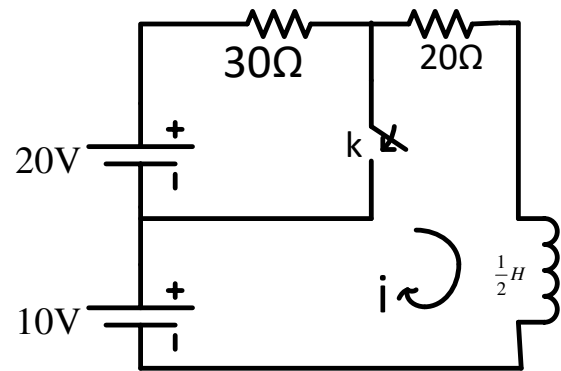


Figure-7

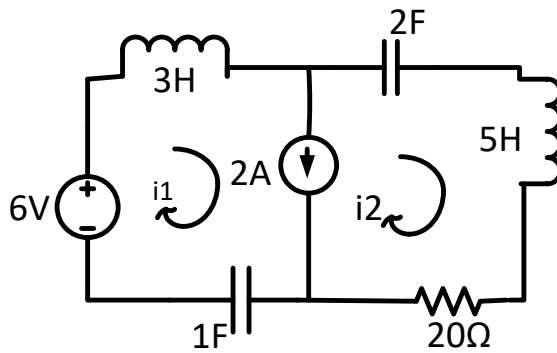


Figure-8

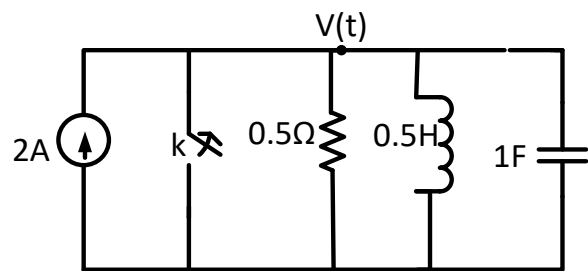


Figure-9

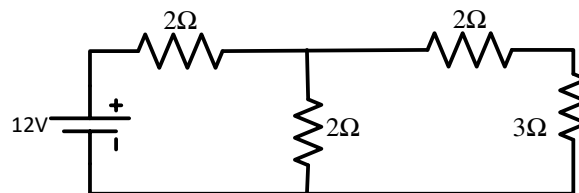


Figure-10

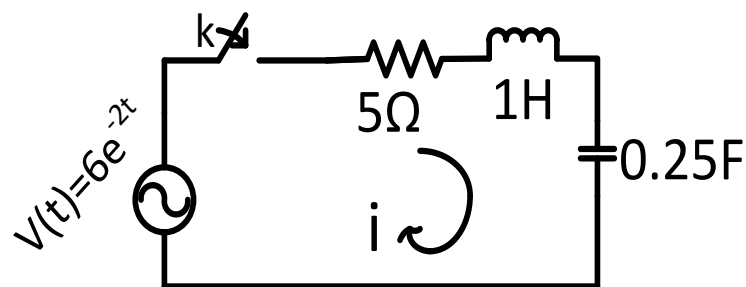


Figure-11

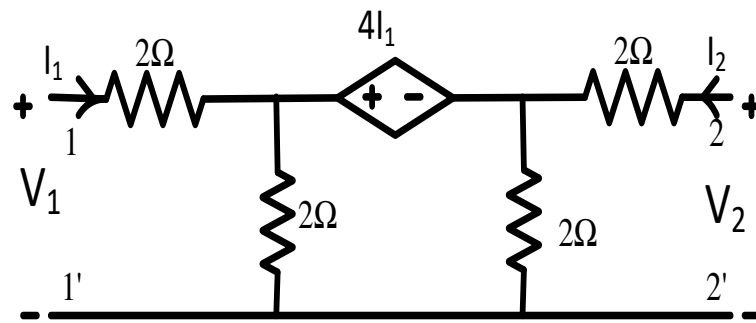


Figure-12

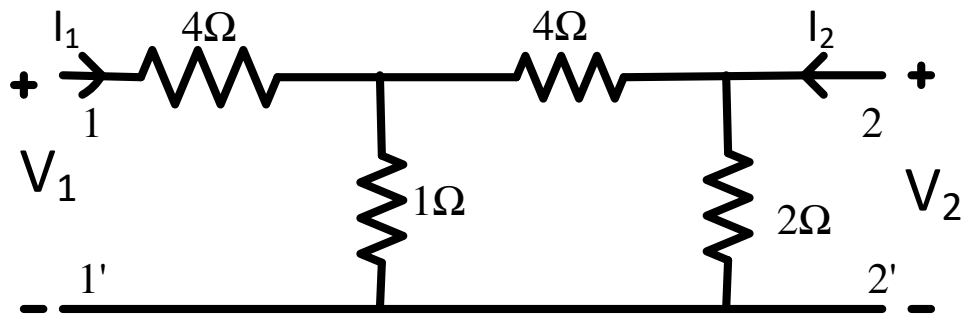


Figure-13