

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

- | | | |
|------------|--|-----------|
| Q.1 | (a) State and explain Reciprocity theorem. | 03 |
| | (b) Develop a step-by-step approach to solving electrical networks using the superposition theorem. | 04 |
| | (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. | 07 |
| Q.2 | (a) Explain the time constant in the context of a series R-L and series R-C circuit. | 03 |
| | (b) Provide an explanation of the initial condition in various passive electrical elements. In network analysis, how important are the initial conditions? | 04 |
| | (c) Determine the node voltages V_1 and V_2 in a network of Fig.1 using node analysis. | 07 |
| | OR | |
| | (c) Find the voltage across 1 k Ω resistor in the circuit shown in Fig 2 using superposition theorem. | 07 |
| Q.3 | (a) Define the term (i) RMS values (ii) Apparent power (iii) Complex power. | 03 |
| | (b) Explain the steps to obtain dual of a network with suitable example. | 04 |
| | (c) Derive relationship between h-parameters and z-parameters. | 07 |
| | OR | |
| Q.3 | (a) Elaborate series-series connection for two-port network. | 03 |
| | (b) Explain Kirchhoff Current Law and Kirchhoff Voltage Law using an appropriate example. | 04 |
| | (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
(i) Voltage across C before the switch is closed and the polarity.
(ii) i_1 and i_2 at $t=0^+$. | 07 |
| Q.4 | (a) Explain concept of Laplace transformation. What are the advantages and disadvantages of Laplace transformation? | 03 |
| | (b) Explain time constant in case of series R-L and series R-C circuit. | 04 |
| | (c) Describe the network's poles and zeros. Provide an explanation of the importance of poles and zeros in various network functions. | 07 |
| | OR | |
| Q.4 | (a) Why are there no simultaneous changes in the voltage in the capacitor and the current in the inductor? | 03 |
| | (b) Generalize relationship of ABCD to z-parameters. | 04 |
| | (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. | 07 |

- 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

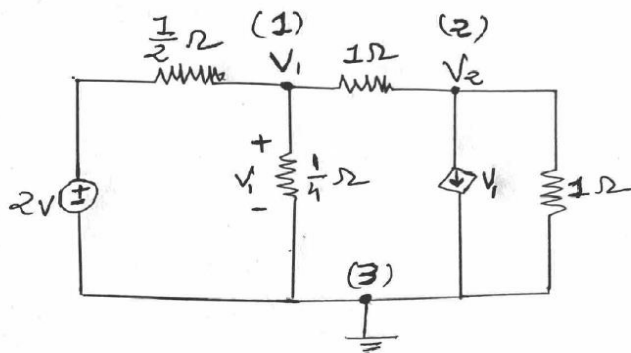


Fig. 1

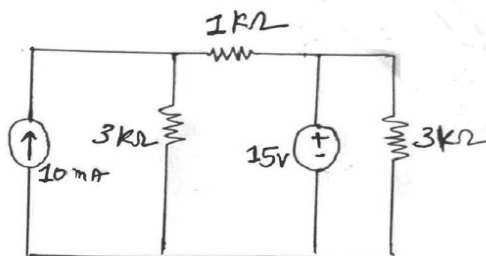


Fig. 2

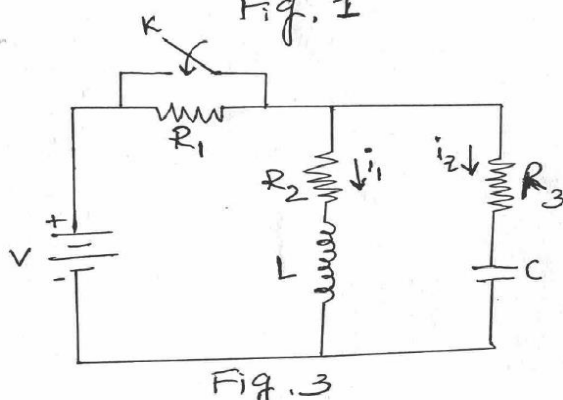


Fig. 3

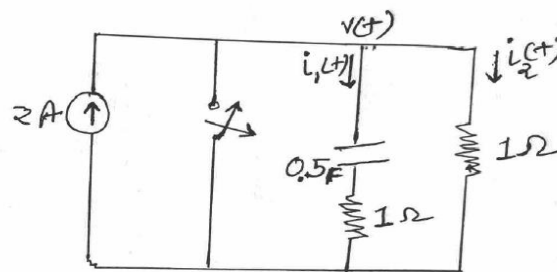


Fig. 4

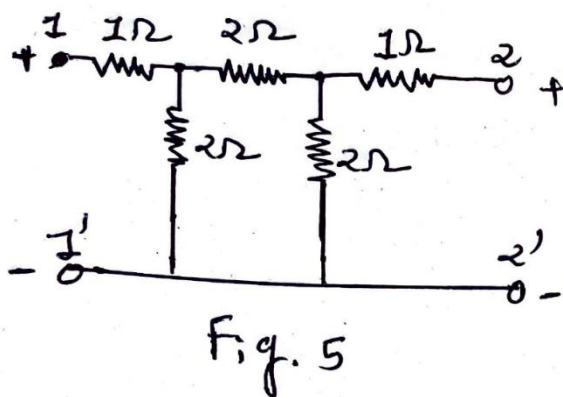


Fig. 5

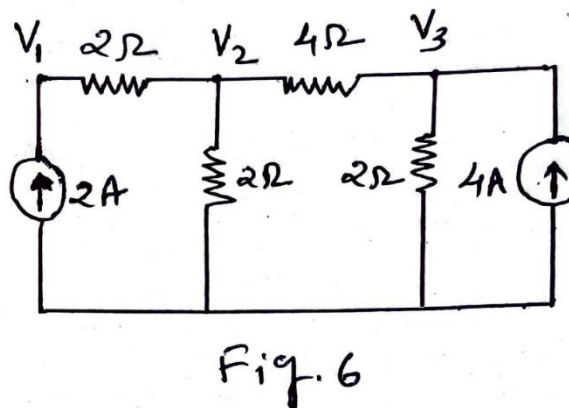


Fig. 6