Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech. (Full Time) - END SEMESTER EXAMINATIONS, APRIL / MAY 2025

ELECTRICAL AND ELECTRONICS ENGINEERING

Semester III

EE23301 ELECTRIC CIRCUIT ANALYSIS

(Regulation 2023)

Time: 3hrs | Max.Marks: 100

Upon completion of the course, the students will be able to understand	
CO 1	the concepts of electrical circuits, fundamental laws and theorems.
CO 2	the natural response and the forced response to excitations of the first and second order networks.
CO 3	the concepts of complex frequency and its use in relating the forced response and natural response.
CO 4	magnetic coupling and two port networks.
CO 5	the concepts of poly phase circuits.

BL – Bloom's Taxonomy Levels

(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

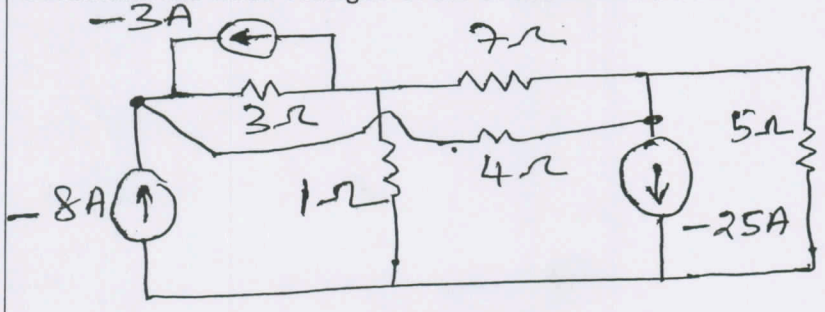
PART- A (10 x 2 = 20 Marks)

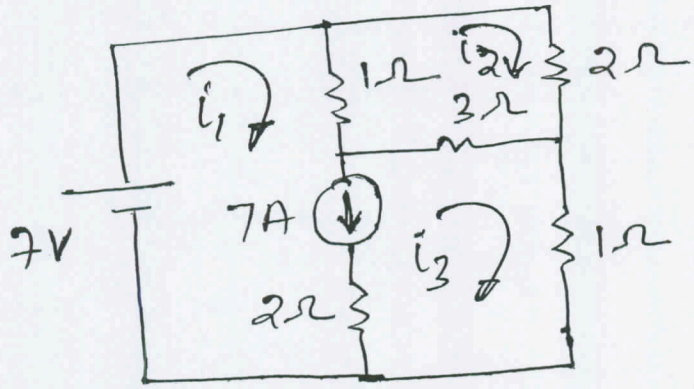
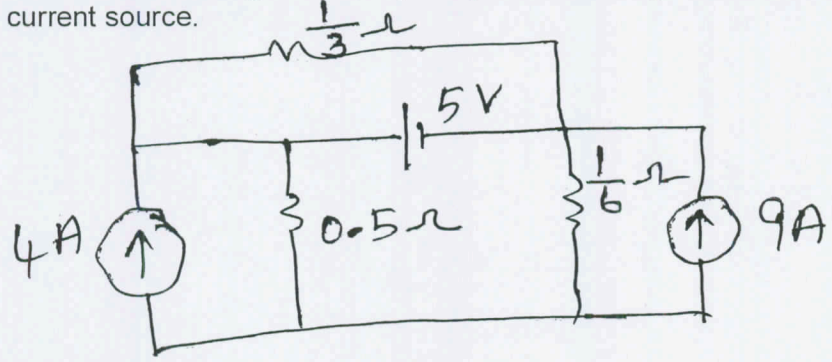
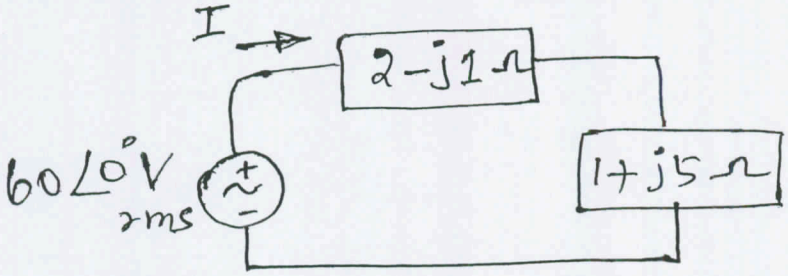
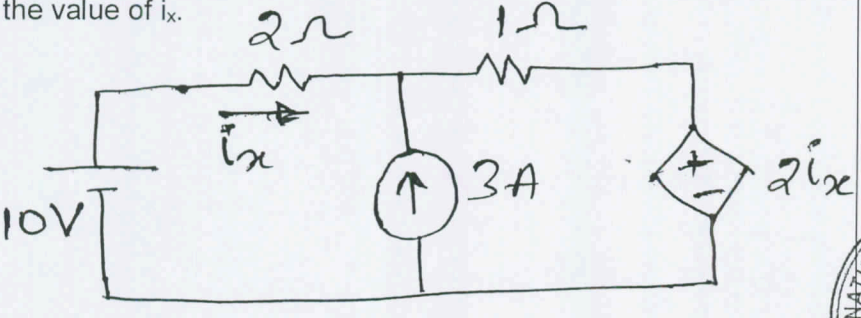
(Answer all Questions)

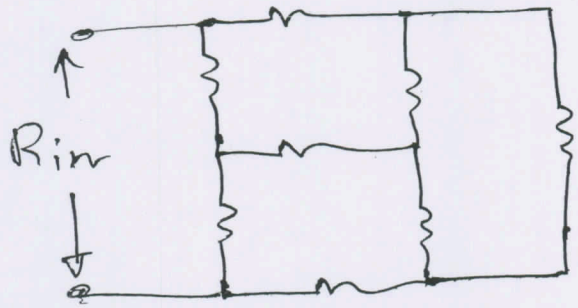
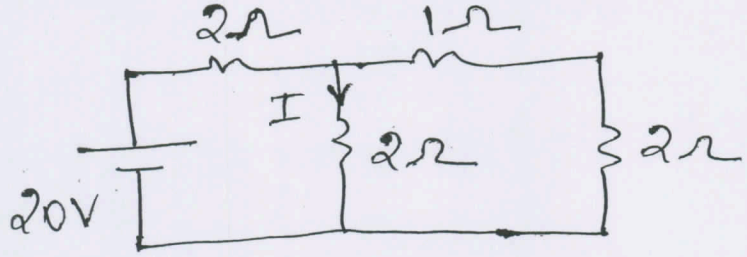
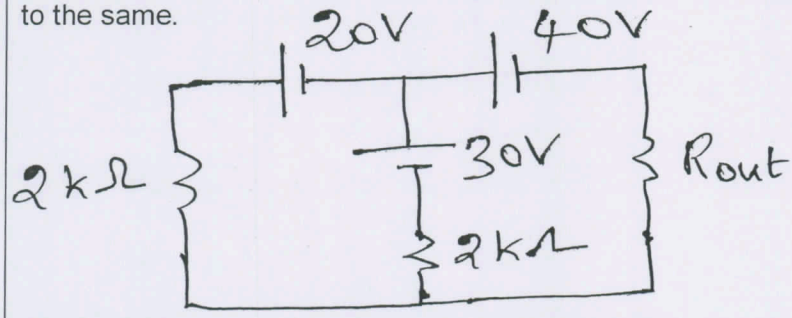
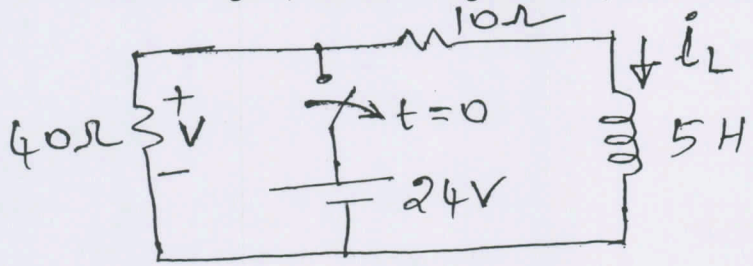
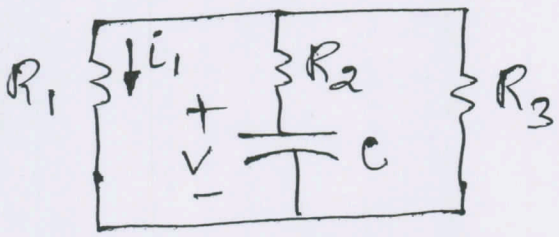
Q. No	Questions	Marks	CO	BL
1	State Kirchhoff's second law.	2	1	L1
2	Define RMS value of an AC quantity.	2	1	L1
3	State Superposition theorem.	2	2	L1
4	Compare dependent and independent sources.	2	2	L1
5	Differentiate transient state from the steady state.	2	3	L1
6	Define time constant of RC circuit.	2	3	L1
7	Specify the status of impedance and circuit current in the series RLC circuit at resonant condition.	2	4	L2
8	What you mean by two port network?	2	4	L2
9	List the merits of two wattmeter method to measure three phase power in the balanced and unbalanced circuits.	2	5	L2
10	Write the relationship between phase and line quantities of voltage and current in star and delta connected system.	2	5	L2

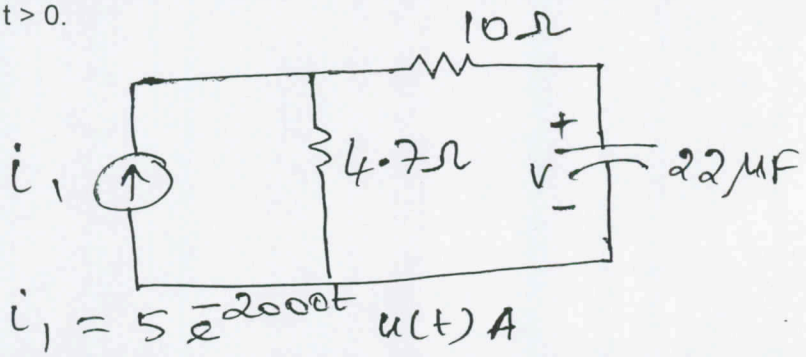
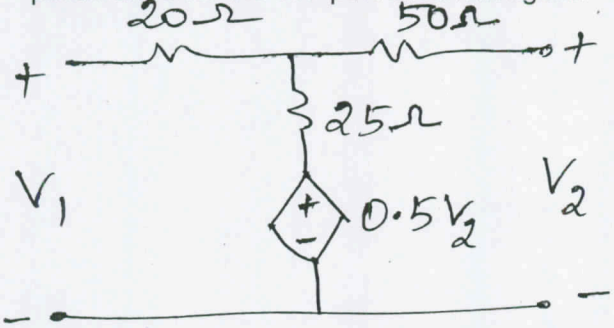
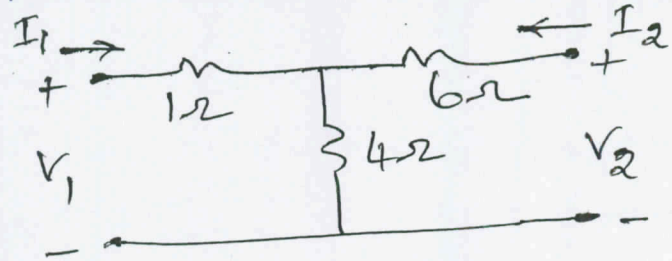
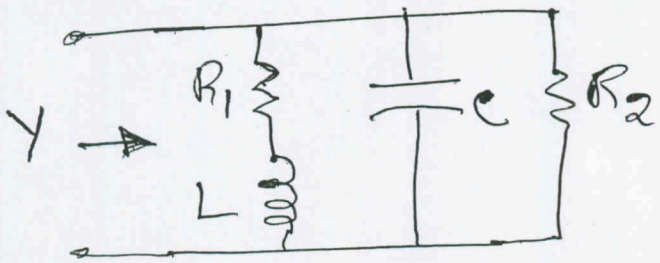
PART- B (5 x 13 = 65 Marks)

(Restrict to a maximum of 2 subdivisions)

Q. No	Questions	Marks	CO	BL
11 (a) (i)	Determine the node voltages of the circuit shown below. 	7	1	L3

(ii)	Determine the three mesh currents in the Fig, shown below. 	6	1	L3
	OR			
11 (b) (i)	For the circuit of figure shown, compute the voltage across each current source. 	7	1	L3
(ii)	Calculate values for the average power delivered to each of the two loads shown in figure, the apparent power supplied by the source, and the power factor of the combined loads. 	6	1	L3
12 (a) (i)	In the circuit of figure, use the superposition principle to determine the value of i_x. 	7	2	L3

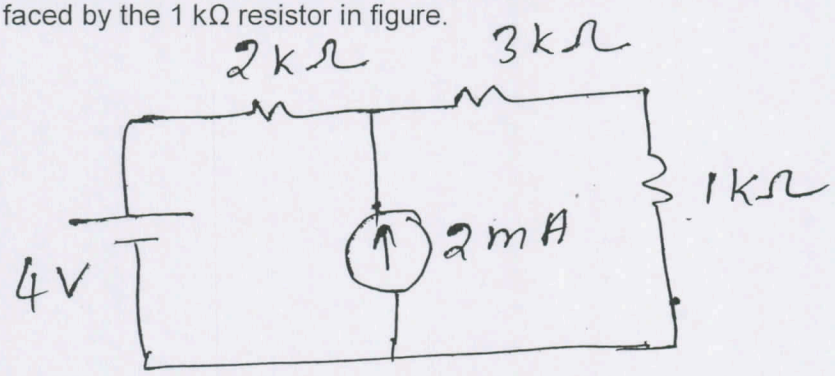
(ii)	Use the technique of star – Delta conversion to find the Thevenin's equivalent resistance of the circuit of figure. Assume, each resistor value in the figure is 10 Ω. 	6	2	L3
	OR			
12 (b) (i)	Prove reciprocity theorem for the circuit shown below. 	7	2	L3
(ii)	Consider the circuit of figure, if R_{out} = 3 kΩ , find the power delivered to the same. 	6	2	L3
13 (a) (i)	For the circuit of figure, find the voltage labelled, V at t = 200 ms. 	7	3	L4
(ii)	Find $V(0^+)$ and $i_1(0^+)$ for the circuit shown in figure, if $V(0^-) = V_0$. 	6	3	L4

	OR			
13 (b) (i)	Determine an expression for V(t) in the circuit of figure, valid for t > 0. 	7	3	L4
(ii)	Sketch the forced and source free response of series RL circuit. Assume the circuit is excited with unit step input voltage. Support the response with necessary mathematical expressions.	6	3	L4
14 (a) (i)	Find z – parameters for the two-port shown in figure. 	7	3	L4
(ii)	The voltage V_s = 100 cosωt mV is applied to a series resonant circuit composed of a 10 Ω resistance, a 200 nF capacitance, and a 2 mH inductance. Calculate the circuit current amplitude, if ω = 48 krad/s.	6	4	L4
	OR			
14 (b) (i)	Find h – parameters for the bilateral resistive circuit drawn in figure. 	7	4	L4
(ii)	Using the values R_1 = 2 Ω , L = 1 H, C = 125 mF, and R_2 = 3 Ω for figure. Determine the resonant frequency and the impedance at resonance. 	6	4	L4

15 (a) (i)	Prove that the two watt-meters are sufficient to measure three phase power. Also derive the expression for power factor.	7	5	L4
(ii)	A balanced three-phase three-wire system has a line voltage of 500 V. Two balanced Wye - connected loads are present. One is a capacitive load with (7 − j2) Ω per phase, and the other is an inductive load with (4 + j2) Ω per phase. Find, (a) the phase voltage; (b) the line current; (c) the total power drawn by the load	6	5	L4
	OR			
15 (b) (i)	Develop the phasor diagram to show the phasor relations between phase quantities (Voltage and Current) and line quantities (Voltage and Current) in star connected system.	7	5	L4
(ii)	Determine the amplitude of the line current in a three-phase system with a line voltage of 300 V that supplies 1200 W to a Delta-connected load at a lagging power factor 0.8. Find the phase impedance.	6	5	L4

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16	Find the Thevenin's and Norton's equivalent circuits for the network faced by the 1 kΩ resistor in figure. 	15	2	L5