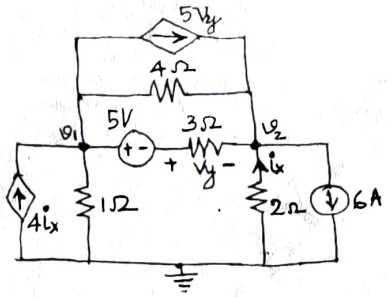
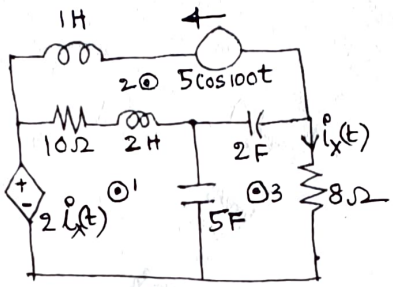
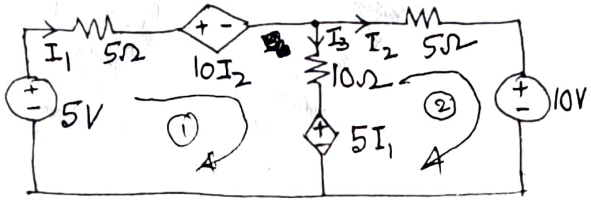
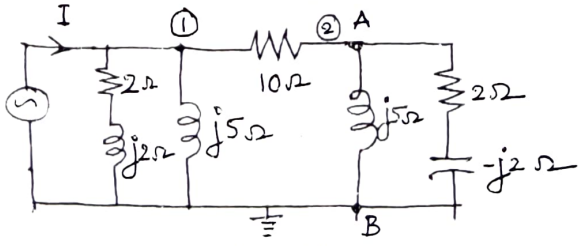
CBCS SCHEME

USN | | | | | | | | | | BEE302

Third Semester B.E./B.Tech. Degree Examination, June/July 2025
Electric Circuit Analysis

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Write a system of nodal equations for the circuit shown in Fig.Q1(a) using the nodal voltages V_1 and V_2 as the variables. What power is furnished by the dependent sources?  Fig.Q1(a)	10	L3	CO1
	b.	Draw the exact dual of the circuit shown in Fig.Q1(b). Use dot method and hence construct nodal and mesh equations.  Fig.Q1(b)	10	L3	CO1
		OR			
Q.2	a.	Describe the branch currents in the network indicated in the Fig.Q2(a) using branch current mesh analysis method.  Fig.Q2(a)	10	L3	CO1
	b.	Use nodal analysis method to find the current 'I' which results in a voltage V_{AB} of $5\angle 30°$ in the circuit shown in Fig.Q2(b).  Fig.Q2(b)	10	L3	CO1

Module – 2

Q.3	a.	Apply superposition theorem to the networks shown in Fig.Q3(a) to find 'i' through 100V source.	10	L2	CO2

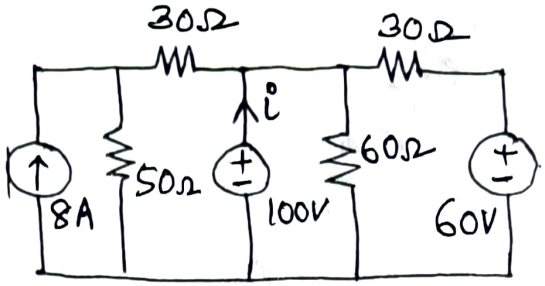


Fig.Q3(a)

	b.	Determine the maximum amount of power that could be dissipated in R_L in the network shown in Fig.Q3(b). Also find the R_L.	10	L2	CO2

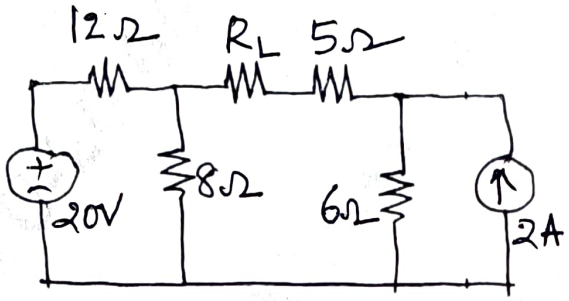


Fig.Q3(b)

OR

Q.4	a.	Use Thevenin's theorem to find the power delivered to the 3Ω resistor in the network of Fig.Q4(a).	10	L3	CO2

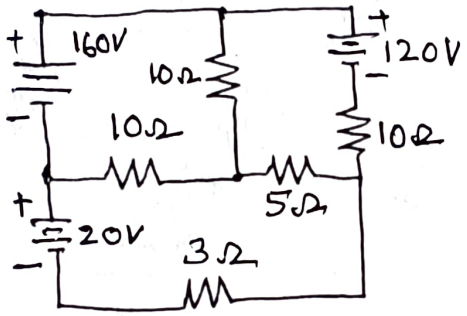


Fig.Q4(a)

	b.	Find the current flowing through the detector having a resistance of 30 Ω as shown in Fig.Q4(b) using Norton's Theorem.	10	L2	CO2

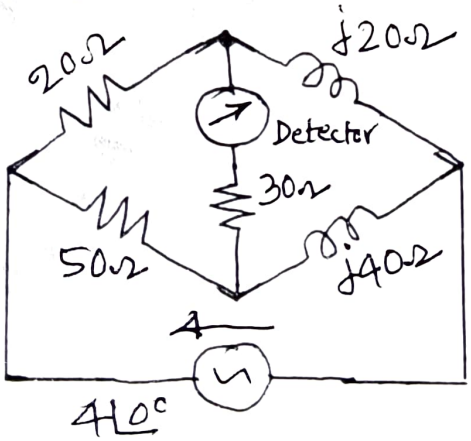
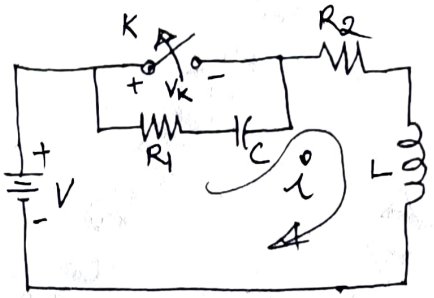
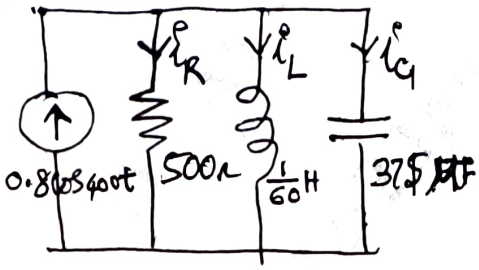
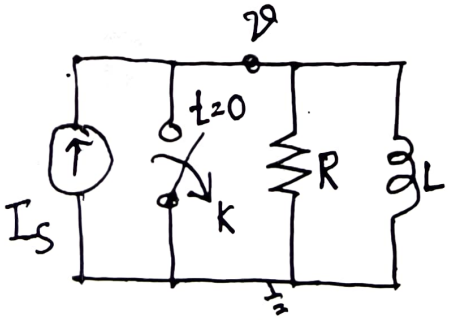
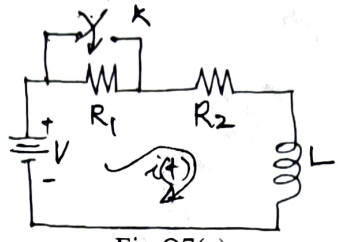
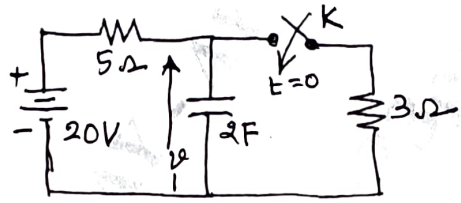
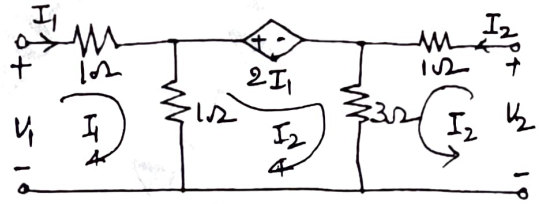


Fig.Q4(b)

Module – 3

Q.5	a.	In the network shown in Fig.Q5(a). The switch ' K' is opened at t = 0 after the network has attained a steady state with switch closed. i) Find an expression for the voltage across the switch at $t = 0^+$ ii) If the parameters are adjusted such that $i(0^+) = 1$ and $\frac{di}{dt}(0^+) = -1$, what is the value of the derivative of voltage across the switch $\frac{dv_k}{dt}(0^+)$?  Fig.Q5(a)	10	L3	CO3
	b.	Derive an expression for the quality factor (Q_0) of a parallel RLC resonant circuit.  Fig.Q5(b)	10	L2	CO3
		OR			
Q.6	a.	A 400V, 200Hz AC source is connected in series with a capacitor and a coil whose resistance and inductance are 20 mΩ and 6 mH, respectively. If the circuit is in resonance at 200 Hz, find : i) Capacitor value ii) The circuit current iii) Voltage across the capacitor iv) The maximum instantaneous energy stored in the coil v) The half–power frequencies for the circuit.	10	L3	CO3
	b.	The network shown in Fig.Q6(b) has the switch 'K' opened at t = 0. Solve for : i) V ii) $\frac{dv}{dt}$ iii) $\frac{d^2V}{dt^2}$ at $t = 0^+$, if I_s = 1A, R = 100 Ω, α = 1H.  Fig.Q6(b)	10	L4	CO3

		Module – 4			
Q.7	**a.**	In the circuit shown in Fig.Q7(a) the battery has remained switched on for a long time. Suddenly the switch 'K' is closed. Using Laplace transformation method, find : i) i(t) ii) If $R_1 = 4\ \Omega$, $R_2 = 8\ \Omega$, d = 4 H and V = 24 V, find the current 1.5 seconds after closing the switch.  Fig.Q7(a)	**10**	**L3**	**CO4**
	b.	Using the initial and final value theorems where they apply, find $f(0^+)$and $f(\infty)$ for the following : i) $F(s) = \frac{(s+1)(s+2)}{(s+3)(s+4)}$ ii) $F(s) = \frac{s}{(s+1)(s-2)}$ iii) $F(s) = \frac{(s+3)(s+7)}{(s+2)(s+5)}$	**10**	**L3**	**CO4**
		OR			
Q.8	**a.**	The circuit shown in Fig.Q8(a) has been in this condition for a long time. At t = 0 the switch is closed. Find using L.T technique i) $V(0^-)$ ii) $V(0^+)$ iii) V(t) iv) What is the time constant of the circuit?  Fig.Q8(a)	**10**	**L3**	**CO4**
	b.	State and prove : i) Initial value theorem ii) Final value theorem as referred to the Laplace transformation operations.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Three impedances $10\angle 0°$, $15\angle 30°$ and $10\angle -30°$ ohm are concreted in star across a balanced 208V system. Take $V_{an} = \left(\frac{208}{\sqrt{3}}\right)\angle 90^0\ V$ as reference voltage. Find the line currents and neutral shift voltage. Construct voltage triangle.	**12**	**L3**	**CO5**
	b.	Find the Z-parameters of the networks shown in Fig.Q9(b). Find where the networks is i) reciprocal ii) symmetrical.  Fig.Q9(b)	**8**	**L3**	**CO5**
		OR			
Q.10	**a.**	Explain ABCD parameters. Derive the conditions of reciprocity and symmetry of transmission parameters.	**10**	**L2**	**CO5**
	b.	A 3-ϕ, 440V symmetrical system supplies a start connected load. $Z_a = 10\angle 30°$, $Z_b = 12\angle 45°$ and $Z_c = 15\angle 45°$ ohm. The phase sequence is abc. Find the neutral shift voltage.	**10**	**L3**	**CO5**

* * * * *