Register Number:……..

KUMARAGURU
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B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2024)

First Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

24ECT101: Network Theory

COURSE OUTCOMES

CO1: Apply circuit laws and network theorems to solve complex DC circuits, including Delta-Star and Star-Delta transformations.

CO2: Analyze AC circuits using phasor representation and two-port network parameters to determine impedance, admittance, and related parameters.

CO3: Evaluate AC power analysis techniques to optimize power transfer and perform power factor correction in complex circuits.

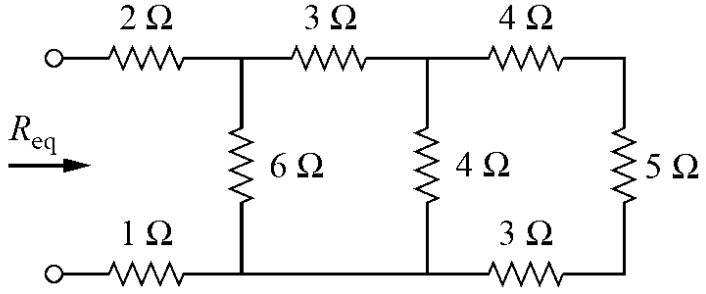
CO4: Examine the transient and steady-state behaviour of first-order and second-order circuits to predict their response to various inputs.

CO5: Design resonance and coupled circuits by calculating mutual inductance and analyzing energy transfer characteristics in passive filters.

Time: Three Hours **Maximum Marks: 100**

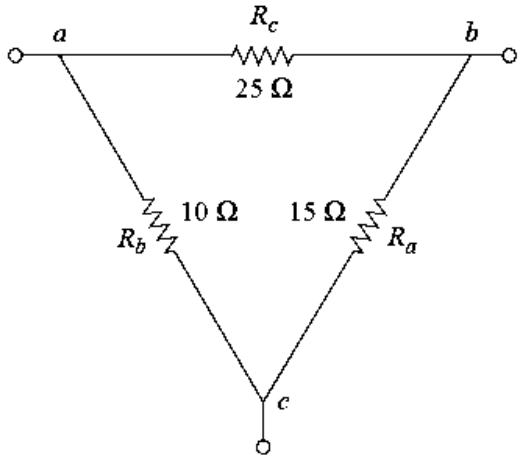
PART A (4 * 20 = 80 Marks)
Answer all the Questions

1.	a)	State and explain Kirchhoff's Current Law (KCL).	2	CO1	[K_2]
	b)	Find the equivalent resistance R_{eq}.	2	CO1	[K_2]

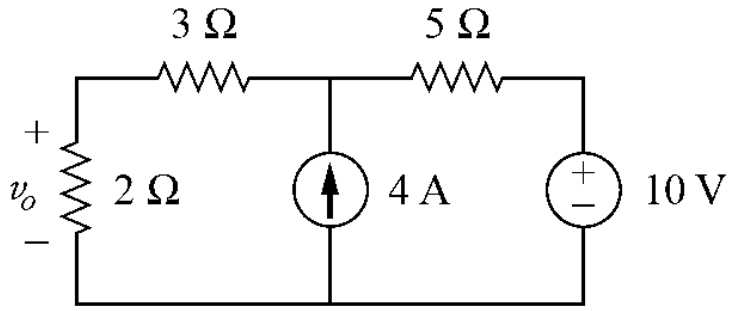


Scenario:

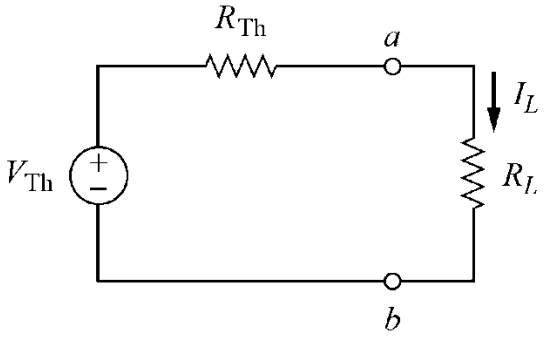
c) A network with resistors $R_a = 15\Omega$, $R_b = 10\Omega$, and $R_c = 25\Omega$ in a Delta configuration is to be converted to Star. Calculate the equivalent resistances. — 6 CO1 [K3]



d) Using Superposition Theorem, solve for **V_0** in the circuit with multiple sources: a 10V voltage source and a 4A current source. — 6 CO1 [K3]

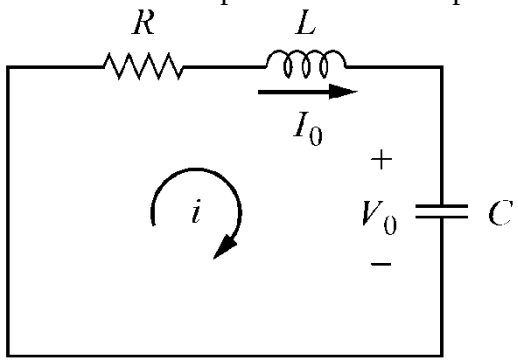


e) Derive the expressions for V_L & I_L with the given Thevenin equivalent DC circuit. — 4 CO1 [K4]



2. a) Define phasor representation and its importance in AC circuit analysis. — 2 CO2 [K2]

b) Compare impedance and admittance in AC circuits. — 2 CO2 [K2]

	c)	Solve for the phasor currents in an AC series circuit with $R = 10\Omega$, $L = 0.2H$, and supply voltage $V = 220V, f = 50Hz$.	6	CO2	[K3]
	d)	Determine the Z-parameters for a two-port network with input voltages and currents $V_1 = 12V, V_2 = 6V, I_1 = 1A, I_2 = 0.5A$.	6	CO2	[K3]
	e)	Differentiate between Transmission (ABCD) and Hybrid (H) parameters in a two-port network.	4	CO2	[K4]
3.	a)	Define the step response of an RL circuit.	2	CO4	[K2]
	b)	Explain the transient behavior of a source-free RC circuit.	2	CO4	[K2]
	c)	Analyze the given series RLC circuit with R = 40Ω , L = 4H & C = 0.2 F and find whether the response is over damped or critically damped or under damped. 	6	CO4	[K4]
	d)	A series RC circuit with $R = 1k\Omega$ and $C = 10\mu F$ is connected to a 10V step input. Calculate the voltage across the capacitor after 1ms.	6	CO4	[K3]
	e)	Discuss the significance of the time constant in first-order circuits.	4	CO4	[K2]
4.	a)	Define resonance in series RLC circuits.	2	CO5	[K1]
	b)	Derive the expression for the coefficient of coupling in magnetically coupled circuits.	2	CO5	[K2]
	c)	**Problem**: A series RLC circuit with $R = 20\Omega, L = 0.1H, C = 10\mu F$ is connected to a 230V, 50Hz source. Determine: i) Resonant frequency, ii) Half power frequencies, iii) Impedance at resonance, iv) Bandwidth, v) Quality factor.	12	CO5	[K4]
	d)	Design a low-pass filter using passive components. Provide the circuit diagram and explain its working.	4	CO5	[K3]

PART B (1x 20 = 20 Marks)
Answer any ONE Question

5.	a)	Define RMS value.	2	CO3	[K_2]
	b)	Differentiate between active power and apparent power.	2	CO3	[K_2]
	c)	For a circuit with $R = 20\Omega$, $L = 0.15H$, and $C = 100\mu F$, connected to a 230V, 50Hz supply, calculate: i) Current, ii) Power factor, iii) Power consumed.	6	CO3	[K_3]
	d)	Discuss the importance of power factor correction in industrial power systems.	6	CO3	[K_4]
	e)	Explain the role of complex power in AC circuit analysis.	4	CO3	[K_2]
		OR			
6.	a)	Define average power.	2	CO3	[K_2]
	b)	What is power factor? State its application in AC circuits.	2	CO3	[K_2]
	c)	Derive the Z-parameters for a two-port network.	12	CO2	[K_3]
	d)	Compare series and parallel resonance circuits in terms of bandwidth and Q-factor.	4	CO5	[K_4]

CO distribution summary:

	CO1	CO2	CO3	CO4	CO5
Marks (%)	20	20	20	20	20

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