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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, NOV / DEC 2024

ECE DEPARTMENT
II Semester
EC3201 - CIRCUIT THEORY
(Regulation 2023)

Time:3hrs Max.Marks: 100

CO1	Ability to apply the basic laws for DC and AC circuits Analysis
CO2	Ability to apply Network Theorems in DC and AC circuits
CO3	Ability to analyse AC circuits for phase relationship and power calculation
CO4	Ability to design and analyse first and second order AC circuits
CO5	Ability to analyse inductively coupled circuits and two port networks

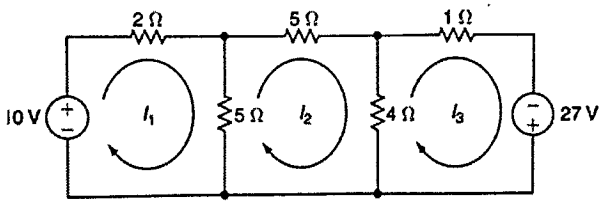
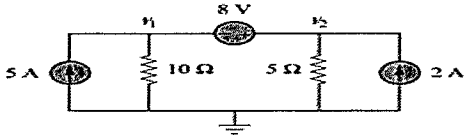
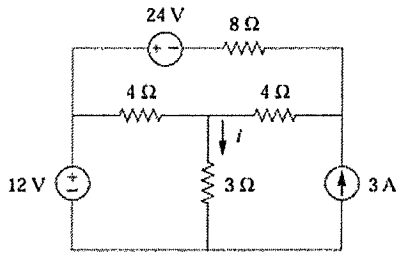
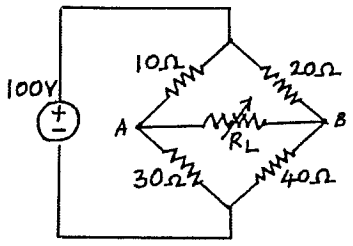
BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

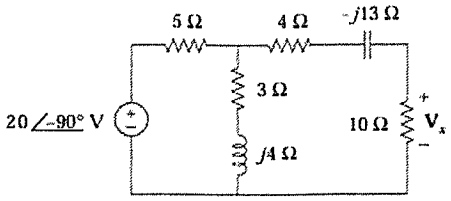
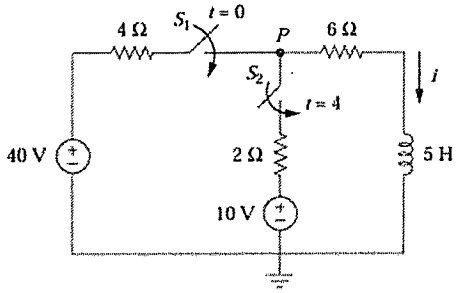
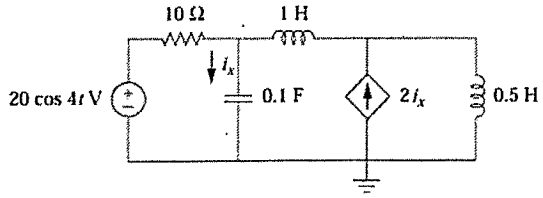
PART- A(10x2=20Marks)
(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	How much energy is required to light a 75-Watt bulb continuously for 90 days? Express your answer in both joules (J) and kilowatt-hours (kWh)	2	1	4
2	Three resistors with resistances R_1=6Ω, R_2=12Ωand R_3=18Ω are connected in parallel to a 24-Volt battery. What is the total current supplied by the battery?	2	1	4
3	Define the linearity property of the system	2	2	1
4	A Thevenin equivalent circuit has a voltage source of V_{th} = 24 V in series with a resistor of R_{th}=8Ω. Draw the Norton equivalent circuit.	2	2	3
5	A source delivers 40 kVA to a load with a power factor of 0.5 leading. Draw the Power Triangle.	2	3	3
6	Draw the phasor diagram for RL and RC Circuits	2	3	3
7	Find the value of inductance for the critically damped case in series RLC circuit given the value of R=3Ω, C=5μF.	2	4	4
8	Compute Quality Factor and Bandwidth for the series RLC Circuit with R = 10Ω, L=0.04 H, C=1μF.	2	5	2
9	In a pair of coupled coils coil 1 has a continuous current of 2A and the corresponding fluxes are φ_{11} and φ_{21} are 0.3 and 0.6 mwb respectively. If the turns are N1 = 500 and N2=1500, Find L1, L2, M and K.	2	5	4
10	Define Coefficient of coupling	2	5	1

PART- B(5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q.No.	Questions	Marks	CO	BL
11 (a)	Using Mesh Analysis, calculate the currents I1, I2 and I3 in the circuit of Fig.Q.11(a). Find the power absorbed by the 4 Ω resistor.	13	1	4

	 Fig.Q.11(a)			
	OR			
11 (b)	Using Nodal Analysis, obtain v1 and v2 in the circuit of Fig.Q.11(b)  Fig.Q.11(b)	**13**	1	4
12 (a)	For the circuit in Fig.Q.12(a), Find the current i using superposition theorem.  Fig.Q.12(a)	**13**	2	5
	OR			
12 (b)	Draw the Thevenin's equivalent circuit at terminals A–B of the circuit in Fig.Q.12(b). Using Thevenin's theorem, find the maximum power that can be delivered to RL.  Fig.Q.12(b).	**13**	2	5

13 (a)	Using the method of Source transformation, determine the voltage Vx in the circuit of Fig.Q.13(a).  Fig.Q.13(a)	13	3	4
	OR			
13 (b)	The voltage across a load is v(t)= 60 cos(t10) V and the current through the element in the direction of the voltage drop is i(t)= 1.5 cos(t 50) A. Find: (a) the complex and apparent powers, (b) the real and reactive powers, and (c) the power factor and the load impedance	13	3	4
14 (a)	At t=0, switch 1 in Fig.Q.14(a) is closed and switch 2 is closed 4 s later. Find i(t) for t>0 . Calculate i for t=2 s and t =5 s.  Fig.Q.14(a)	13	4	2
	OR			
14 (b)	A series RLC network has R= 4 kΩ , L= 20 mH, and C= 1 μF. Take Vm= 30V. Find the (i) resonant frequency ω0 and the half-power frequencies (ω1, ω2) (ii)quality factor Q and the bandwidth B (iii)amplitude of the current at ω0, ω1, and ω2 (iv)average power dissipated at ω = ω0, ω1, ω2.	13	4	2
15 (a)	Apply nodal analysis to find the value of i_x in the circuit depicted in Fig. Q.15(a)  Fig. Q.15(a)	13	5	3
	OR			
15 (b)	For the oriented graph [Twigs (tree)-1,2,3 and links-4,5,6] of Fig.Q.15(b), obtain the loop Incidence matrix (tie - set matrix) B. Express the branch currents in terms of the loop currents. *	13	5	3

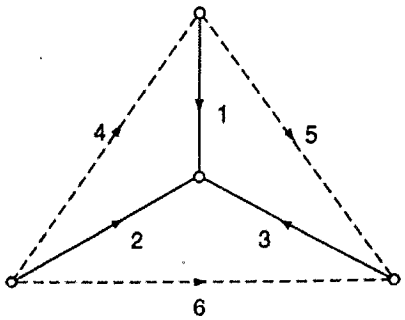
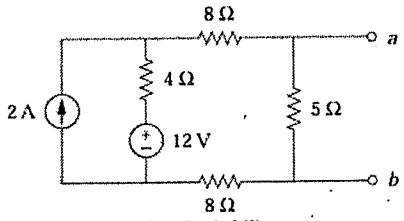
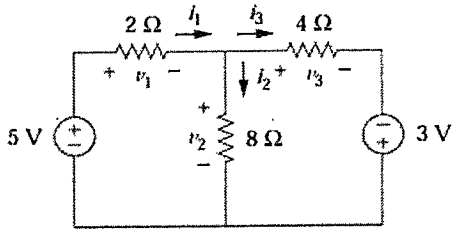


Fig.Q.15(b)

PART- C(1x 15=15Marks)
(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16(i)	Find the Norton equivalent circuit of the circuit in Fig.Q.16(i) at terminals a-b.  Fig.Q.16(i)	10	1	4
(ii)	Find the currents and voltages in the circuit shown in Fig.Q.16(ii).  Fig.Q.16(ii)	5	1	4