Ref. No. Ex /IEE/PC/B/T/212/2023(S)

B.I.E.E. 2nd Yr. 1st Semester Supplementary Examination, 2023

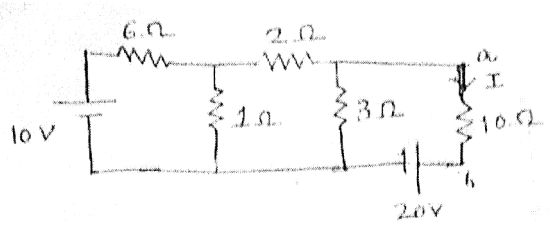
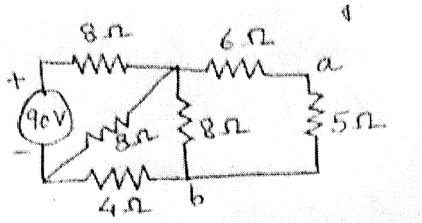
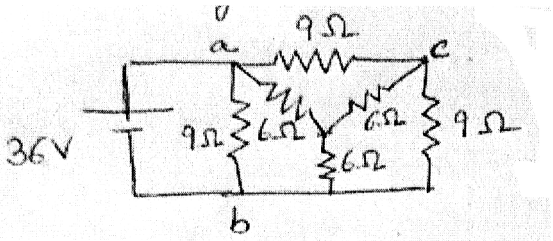
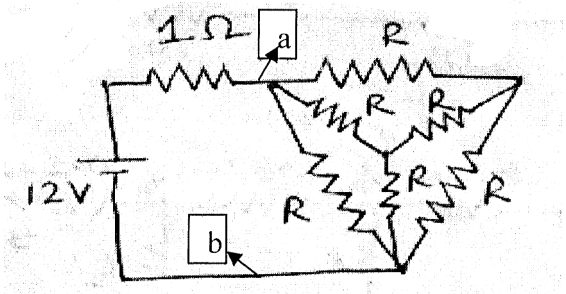
SUBJECT: Circuit Theory

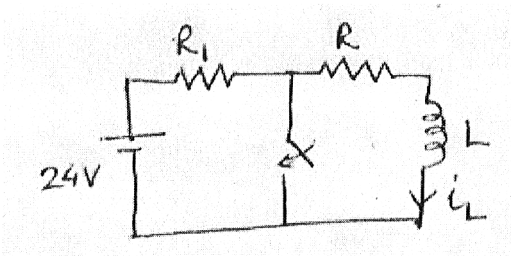
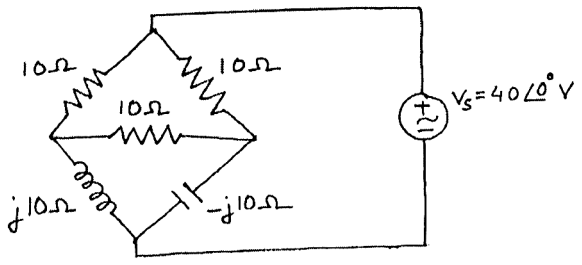
Total Time: Three hours

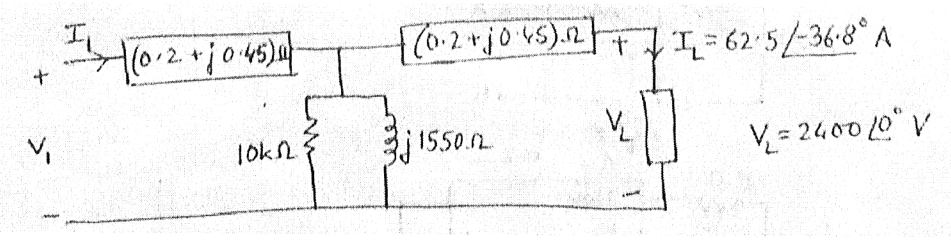
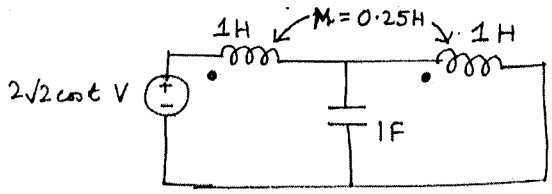
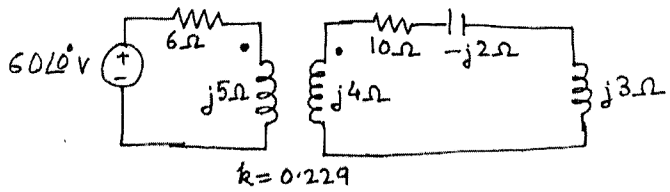
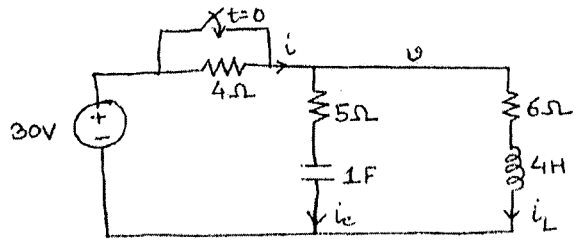
Full Marks 100

All Questions are Compulsory.

CO1:Q1,2 CO2:Q3,4 CO3: Q5,6 CO4: Q7,8

Q.No.		Marks
1.	a) Find the Thevenin equivalent of the ckt. below wrt *ab* and determine I through the 10Ω resistor. 	8
	OR	
	b) Find the Norton equivalent at terminals *ab* for 	8
2.	a) Determine resistance across terminals *ab*. Calculate voltage across terminals *ac* if a 36V battery is connected across terminals *ab*. 	10
	OR	
	b) Determine R so that power into terminals *ab* is maximum. Calculate maximum power. 	10

Q.No.		Marks
3.	a) A 50 μF capacitor is discharged through a 100 kΩ resistor. If the capacitor was charged to 400V initially, then (i) find initial energy stored W_0, (ii) time constant τ, (iii) expression for energy stored in capacitor $w_C(t)$ in terms of W_0, t and τ and (iv) energy stored after 600ms. How long will it take for the capacitor to discharge to 0.072 J?	12
	OR	
	b) In the Fig. shown, i_L=10mA at 2ms and 3.68mA at 6ms. Determine the time constant τ. For R=R_1=4Ω and L=2H, determine (i) the current transient, (ii) energy stored at t=0.25s for initial current of 4A and (iii) how long will it take to discharge to 0.8J? 	12
4.	a) Derive the natural response i(t) for the underdamped series RLC circuit and draw detailed response. State from derivation and indicate the following in the figure: (i) starting value (ii) upper and lower envelopes with their maximum values (iii) maximum overshoot and (iv) peak time and (v) 5% tolerance band.	16
	OR	
	b) An iron plunger is drawn into a solenoid of resistance 50 Ω against a spring. 2.5A current flows into it nominally for a 250V, 50Hz supply. This drops to 1A when the plunger is drawn into the solenoid. Calculate i) impedance, ii) reactance, iii) inductance of solenoid and iv) stored energy for both positions of the solenoid.	16
5.	a) On applying 100V at 50Hz, 8A current flows and 120W power is consumed in coil A while 10A current and 500W power is consumed in coil B. If this supply is applied to the series connection of coils A and B, determine the resultant current and power consumed.	12
	OR	
	b) In the bridge circuit shown, calculate the current through the inductor, capacitor and the three resistors. How much is the power supplied by the voltage source? 	12

Q.No.		Marks
6.	a) Calculate V_1 and I_1 in the transformer circuit shown below. 	14
	OR	
	b) The voltages across a resistor, an inductor (coil) and a capacitor of a series RLC circuit are 170, 150 and 100V resp. and the current is 4A when 200V is applied across it. Determine power factors of the inductor and the circuit.	14
7.	a) Write the mesh equations. Find the voltage across the capacitor. 	14
	OR	
	b) Write the mesh equations. Find the input impedance. 	14
8.	a) Three resistors of 3, 4, 5 Ω respectively are star connected to a 3-phase 400V symmetrical system, phase sequence RYB. Find a) the currents in each resistor, b) the power dissipated in each resistor c) the phase angles between the currents and the corresponding voltages d) star point potential.	14
	OR	
	b) Using Laplace transform, calculate i(t). Determine the initial conditions i_L, v_C and i_C at t=0+. 	14