SIDDHARTH INSTITUTE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS), PUTTUR

(Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu)
(Accredited by NAAC with "A+" Grade & ISO 9001 : 2008 Certified Institution)

QUESTION BANK (DESCRIPTIVE)

Subject with Code : ELECTRICAL CIRCUIT ANALYSIS-1 (23EE0203)
Course & Branch: B. Tech –EEE
Year & Semester: I - B. Tech. & II-Semester **Regulation:** R23

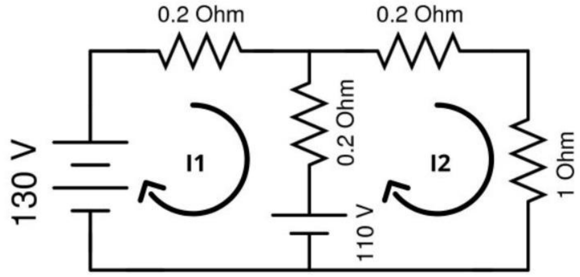
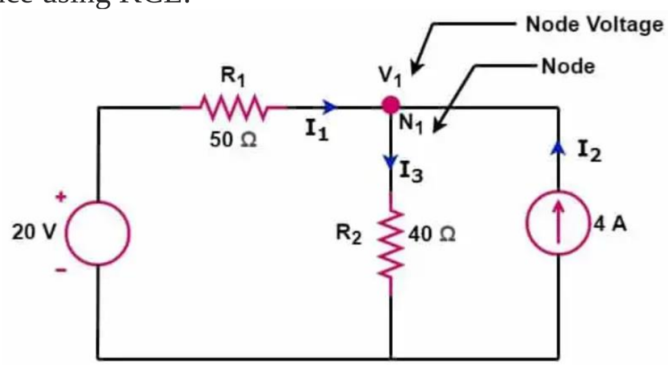
UNIT I

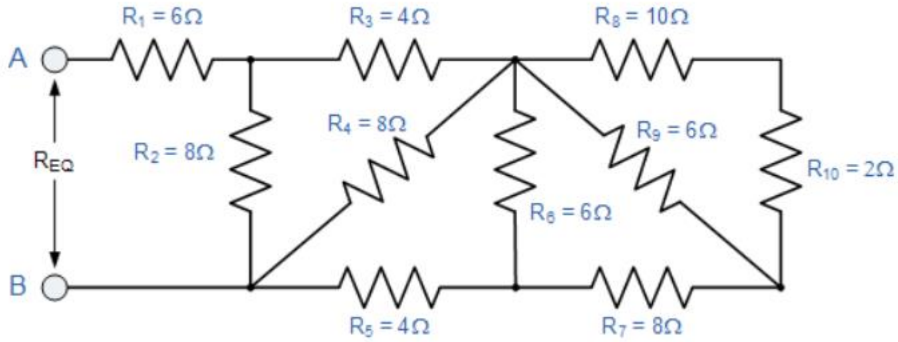
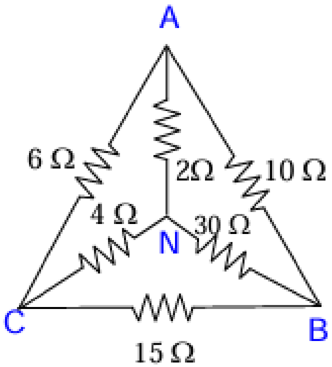
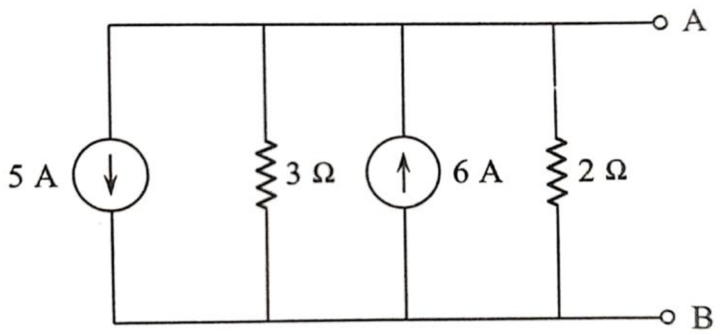
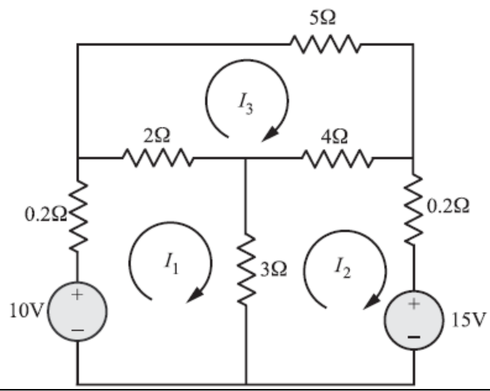
INTRODUCTION TO ELECTRICAL CIRCUITS

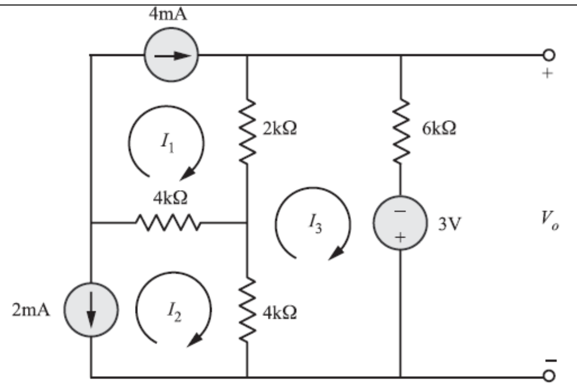
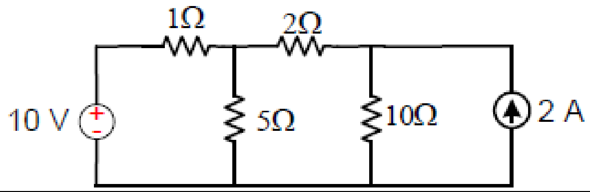
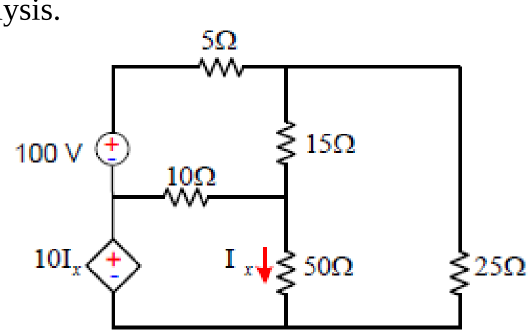
PART-A (2 MARKS)

1.	**Define potential difference.**	**[L2][CO1]**	**[2M]**
2.	**Define Independent source and Dependent sources**	**[L2][CO1]**	**[2M]**
3.	**Define branch, node, mesh or loop**	**[L2][CO1]**	**[2M]**
4.	**Define practical voltage source.**	**[L2][CO1]**	**[2M]**
5.	**Write the characteristics of series connection of resistances.**	**[L2][CO1]**	**[2M]**

PART-B (10 MARKS)

1.		What are the V-I relationships for the elements R, L, and C? and explain briefly.	**[L1][CO1]**	**[10M]**
2.		Explain briefly about Independent and Dependent Voltage and Current Sources.	**[L5][CO1]**	**[10M]**
3.	**(a)**	Define Kirchoff's voltage law. Find the current flowing through 1 Ω resistance by using Kirchhoff's voltage law. 	**[L2][CO1]**	**[5M]**
	(b)	Define Kirchoff's current law. find the current through R1 and R2 resistance using KCL. 	**[L2][CO1]**	**[5M]**

<table>
<tr><td>4.</td><td></td><td>Find the equivalent resistance, REQ for the following resistor combination circuit.

</td><td>[L1][CO1]</td><td>[10M]</td></tr>
<tr><td>5.</td><td>(a)</td><td>Develop transformation formulae for Star to Delta transformation.</td><td>[L1][CO1]</td><td>[5M]</td></tr>
<tr><td></td><td>(b)</td><td>Develop transformation formulae for Delta to Star transformation.</td><td>[L1][CO1]</td><td>[5M]</td></tr>
<tr><td>6.</td><td></td><td>Determine the equivalent resistance between (1) A and B and (2) A and N.

</td><td>[L4][CO1]</td><td>[10M]</td></tr>
<tr><td>7.</td><td>(a)</td><td>Explain about Source transformation technique.</td><td>[L5][CO1]</td><td>[5M]</td></tr>
<tr><td></td><td>(b)</td><td>Convert the current source into equivalent voltage sources

</td><td>[L4][CO1]</td><td>[5M]</td></tr>
<tr><td>8.</td><td>(a)</td><td>Determine the loop currents and all branch currents using mesh analysis.

</td><td>[L4][CO1]</td><td>[5M]</td></tr>
<tr><td></td><td>(b)</td><td>Find the voltage V_0 in the circuit shown in</td><td>[L1][CO1]</td><td>[5M]</td></tr>
</table>

<table>
<tr><td></td><td></td><td>
</td><td></td><td></td></tr>
<tr><td>9.</td><td></td><td>Determine all branch currents and the voltage across the 5 Ω resistor by node analysis.

</td><td>[L4][CO1]</td><td>[10M]</td></tr>
<tr><td>10.</td><td></td><td>Find the power delivered by the dependent voltage source in the circuit shown by mesh analysis.

</td><td>[L1][CO1]</td><td>[10M]</td></tr>
</table>

UNIT II

MAGNETIC CIRCUITS

PART-A (2 MARKS)

1.	**How to know the Direction of the Magnetic Field?**	**[L3][CO2]**	**[2M]**
2.	**What is Magnetic Motive Force (MMF) in Electrical Engineering?**	**[L2][CO2]**	**[2M]**
3.	**What is Self-Induction?**	**[L2][CO2]**	**[2M]**
4.	**Define mutual inductance.**	**[L2][CO2]**	**[2M]**
5.	**State dot rule for coupled coils.**	**[L1][CO2]**	**[2M]**

PART-B (10 MARKS)

1.	(a)	Define Magneto Motive Force (MMF), Magnetic Flux density, and Reluctance.	**[L2][CO2]**	**[6M]**
	(b)	Calculate the magneto motive force required to produce a flux of 0.015Wb across an air gap 2.5mm long, having an effective area of 200cm^2.	**[L2][CO2]**	**[4M]**
2.		Summarise the difference between electric and magnetic circuits.	**[L5][CO2]**	**[10M]**
3.		State Faraday's law of electromagnetic induction.	**[L1][CO2]**	**[10M]**
4.		Determine mutually and self-induced electromagnetic fields with a neat representation.	**[L2][CO2]**	**[10M]**
5.		Two coils connected in series have an equivalent inductance of $0.8H$ when connected in aiding and an equivalent inductance of $0.4H$ when connected in opposing. Determine the mutual inductance. Calculate the self-inductance of the coils, by taking K=0.55.	**[L2][CO2]**	**[10M]**
6.		Give a brief overview of dot convention in coupling circuits.	**[L2][CO2]**	**[10M]**
7.	(a)	Derive an expression for coefficient coupling.	**[L3][CO2]**	**[5M]**
	(b)	Two coils connected in a series-aiding manner have a total inductance of 275 mH. When connected in a series-opposing configuration, the coils have a total inductance of 125 mH. If the inductance of one coil (L1) is three times the other, find L1, L2, and M. What is the coupling coefficient?	**[L2][CO2]**	**[5M]**
8.		Two coils A & B of 1200 turns and 1500 turns respectively lie in a parallel plane, so that 40% of flux produced by coil-A links with coil-B. A current of 4A in coil-A produce a flux of 0.5×10^{-4} Wb. While the same current in coil-B produces a flux of 0.8×10^{-4} Wb. Determine the coefficient of coupling between the coils.	**[L2][CO2]**	**[10M]**
9.	(a)	Derive an expression for composite magnetic circuits.	**[L3][CO2]**	**[5M]**
	(b)	A closed magnetic circuit of cast steel contains a 6 cm long path of cross-sectional area 1 cm2 and a 2 cm path of cross-sectional area 0.5 cm2. A coil of 200 turns is wound around the 6 cm length of the circuit and a current of 0.4 A flows. Determine the flux density in the 2 cm path, if the relative permeability of the cast steel is 750.	**[L2][CO2]**	**[5M]**
10.	(a)	Explain the concept of Series and Parallel Magnetic Circuits.	**[L2][CO2]**	**[5M]**
	(b)	A coil having an inductance of $100mH$ is magnetically coupled to another coil having an inductance of $900mH$. The coefficient of coupling between	**[L2][CO2]**	**[5M]**

		the coils is 0.45. calculate the equivalent inductance if the two coils are connected in (i) series aiding, (ii) series opposing, (iii) parallel aiding, and (iv) parallel opposing.		

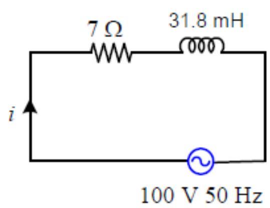
UNIT III

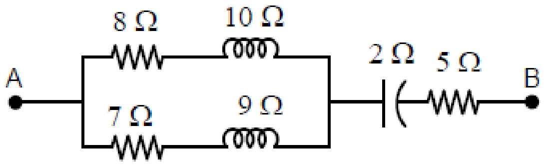
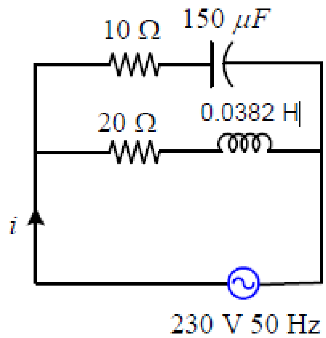
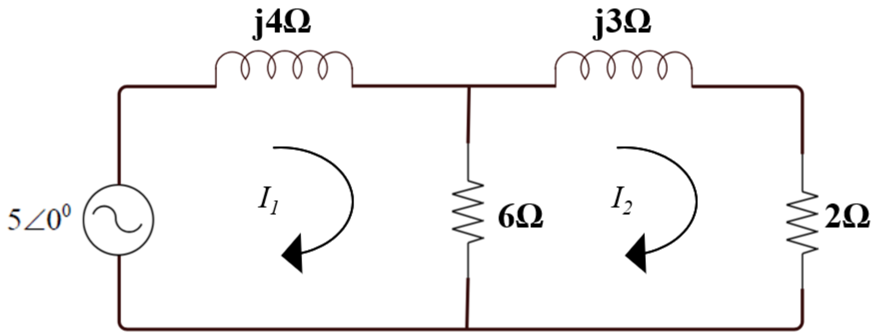
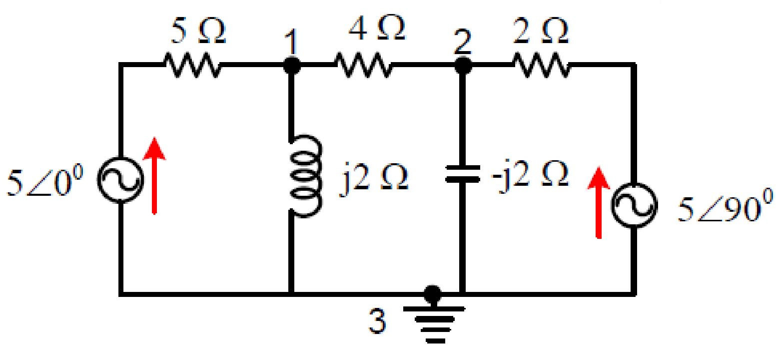
SINGLE PHASE CIRCUITS

PART-A (2 MARKS)

1.	A load consisting of 3Ω resistance and 4 Ω inductive reactance draw a current of 10 A when connected to a sinusoidal source. Determine the voltage and power in the load.	**[L2][CO3]**	**[2M]**
2.	When a sinusoidal voltage of 120V is applied across a load, it draw a current of 8A with a phase lead of 30°. Determine the resistance and impedance of the load.	**[L2][CO3]**	**[2M]**
3.	Write the impedance equation for series RL, RC, RLC and parallel RL, RC, RLC.	**[L1][CO3]**	**[2M]**
4.	Determine the power factor of RLC series circuit with R=5Ω, X_L=8Ω and X_C=12 Ω.	**[L4][CO3]**	**[2M]**
5.	Write the sinusoidal voltage and current equation for series RL, RC, RLC and parallel RL, RC, RLC.	**[L1][CO3]**	**[2M]**

PART-B (10 MARKS)

1.		What Is a Periodic Function? Write the characteristics and properties of periodic functions.	**[L1][CO3]**	**[10M]**
2.		Derive an expression for the average value and RMS value of Sinusoidal Current or Voltage.	**[L2][CO3]**	**[10M]**
3.	(a)	Describe the sinusoidal function and explain the phasor and phasor diagram concepts.	**[L5][CO3]**	**[6M]**
	(b)	An alternating current carrying sinusoidally with a frequency of 50 Hz has a maximum value of 100 A. Calculating time from the instant when the current is zero and is becoming positive, calculate a) the instantaneous value after 1/300 sec. b) the time taken for the current to reach 80 A for the first time.	**[L2][CO3]**	**[4M]**
4.		Determine the steady-state analysis for the response of a pure resistor, a pure inductor, and a pure capacitor to the sinusoidal excitations and derive the average power equations.	**[L4][CO3]**	**[10M]**
5.	(a)	Determine the series RL and RC circuit excited by a sinusoidal source	**[L4][CO4]**	**[6M]**
	(b)	A resistance of 7Ω is connected in series with a pure inductance of 31.8 mH and the circuit is connected to a 100 V, 50 Hz sinusoidal supply. Calculate i) circuit current ii) Phase angle iii) Power factor iv) Power. 	**[L2][CO4]**	**[4M]**
6.	(a)	Determine the series RLC circuit excited by a sinusoidal source	**[L4][CO4]**	**[5M]**
	(b)	A 230V, 50Hz ac supply is applied to a coil of 0.06H inductance and 2.5Ω resistance connected in series with a 6.8μF capacitor. Calculate (i) impedance	**[L2][CO4]**	**[5M]**

		(ii) current (iii) phase angle between current and voltage (iv) power factor (v) power consumed		
7.	(a)	Determine the parallel RL and RC circuit excited by a sinusoidal source.	**[L4][CO4]**	**[6M]**
	(b)	In the arrangement shown in the figure. Calculate the impedance between AB and the phase angle between voltage and current. Also calculate the total power consumed, if the applied voltage between AB is 200∠30°. 	**[L2][CO4]**	**[4M]**
8.	(a)	Determine the parallel RLC circuit excited by a sinusoidal source	**[L4][CO4]**	**[5M]**
	(b)	A coil having a resistance of 20Ω and inductance of 0.0382 H, is connected in parallel with a circuit consisting of a 150 μF capacitor in series with 10Ω resistors. The arrangement is connected to a 230 V, 50 Hz supply. Determine the current in each branch. Also, find the total supply current for the given circuit. 	**[L2][CO4]**	**[5M]**
9.		Find the mesh current equations in the circuit shown in the figure. 	**[L2][CO4]**	**[10M]**
10.		Determine node voltage by nodal analysis for the circuit shown in the figure. 	**[L4][CO4]**	**[10M]**

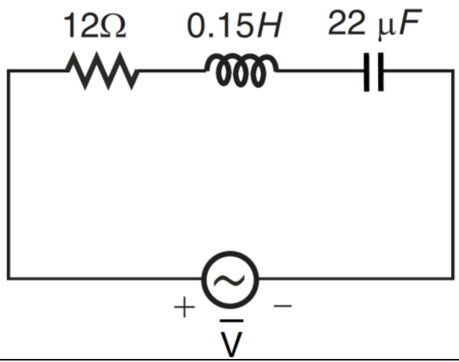
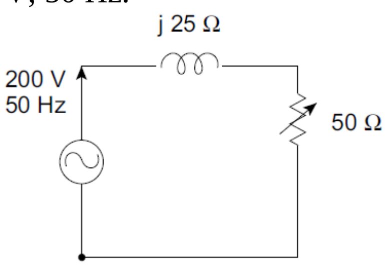
UNIT IV

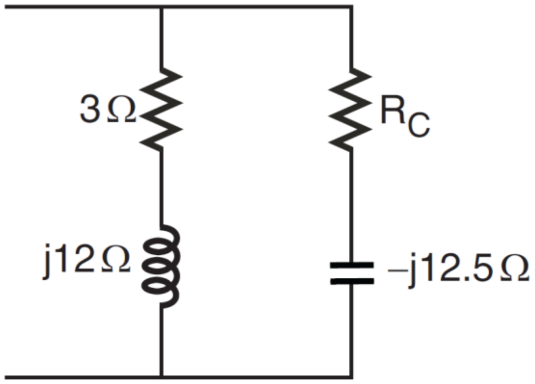
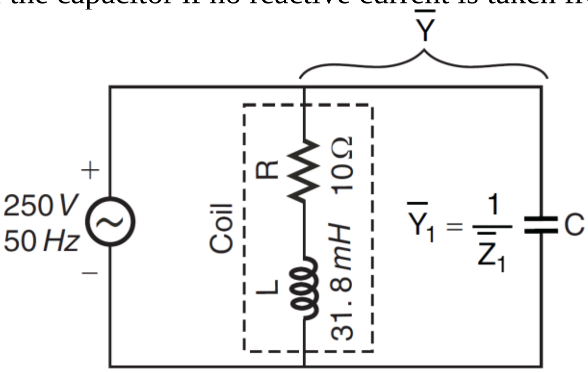
RESONANCE AND LOCUS DIAGRAM

PART-A (2 MARKS)

1.	Write the expression for the bandwidth of the RLC series and parallel circuit.	**[L1][CO5]**	**[2M]**
2.	Define quality factor.	**[L2][CO5]**	**[2M]**
3.	**How is the resonant frequency related to half-power frequencies in RLC series/parallel circuits?**	**[L1][CO5]**	**[2M]**
4.	**Draw the frequency response of series and parallel RLC circuits.**	**[L1][CO6]**	**[2M]**
5.	**Write the expression for the quality factor of the series and parallel RLC circuit.**	**[L2][CO6]**	**[2M]**

PART-B (10 MARKS)

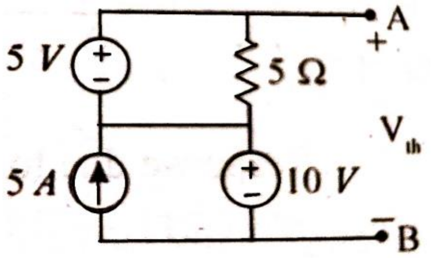
1.		Determine the expressions for resonant frequency and Q-factor for a series R-L-C circuit.	**[L4][CO6]**	**[10M]**
2.		For the RLC circuit shown in the figure, Determine the impedance at (i) Resonant frequency, (ii) 10 *Hz* below resonant frequency, and (iii) 10 *Hz* above resonant frequency. 	**[L2][CO6]**	**[10M]**
3.		Derive an expression for half power frequencies and Bandwidth of RLC series circuit.	**[L2][CO6]**	**[10M]**
4.	(a)	Prove that $f_0 = \sqrt{(f_l f_h)}$ where f_l and f_h are the two half power frequencies of a resonant circuit.	**[L4] [CO6]**	**[5M]**
	(b)	A RLC series circuit of R=16Ω, L=5mH, C=2μF. Calculate the quality factor, bandwidth, and half-power frequencies.	**[L2][CO6]**	**[5M]**
5.		An RLC series circuit is to be designed to produce a magnification of 10 at 100 rad/s. The 100 V source connected to an RLC series circuit can supply a maximum current of 10 A. The half-power frequency impedance of the circuit should not be more than 14.14 Ω. Find the values of R, L and C.	**[L2][CO6]**	**[10M]**
6.	(a)	Draw the Locus diagram of a Series RL Circuit?	**[L2][CO6]**	**[5M]**
	(b)	For the circuit shown in Figure. plot the locus of the current, mark the range of *I* for maximum and minimum values of R, and the maximum power consumed in the circuit. Assume X_L=25 Ω and R=50 Ω. The voltage is 200 V; 50 Hz. 	**[L2][CO6]**	**[5M]**

7.	(a)	Obtain an expression for resonant frequency in a parallel resonant circuit.	**[L2][CO6]**	**[5M]**
	(b)	The parameters of an RLC parallel circuit excited by a current source are R=40 Ω, L=2 *mH*, C= 3 *μF*. Determine the resonant frequency, quality factor, bandwidth and cut-off frequencies.	**[L2][CO6]**	**[5M]**
8.		Show that a two-branch parallel circuit is resonant at all frequencies if $R_L = R_C = \sqrt{\frac{L}{C}}$ where RL is the resistor in the inductor branch and RC is the resistor in the capacitor branch.	**[L2][CO6]**	**[10M]**
9.		In the RLC network shown in figure, determine the value of RC for resonance. Also calculate the dynamic resistance. 	**[L2][CO6]**	**[10M]**
10.	(a)	Write the expression for admittance of RLC parallel circuit at half power frequencies.	**[L2][CO6]**	**[4M]**
	(b)	A coil of inductance 31.8 *mH* and resistance 10 Ω is connected in parallel with a capacitor across a 250 V, 50 Hz supply as shown. Determine the value of the capacitor if no reactive current is taken from the supply. 	**[L2][CO6]**	**[6M]**

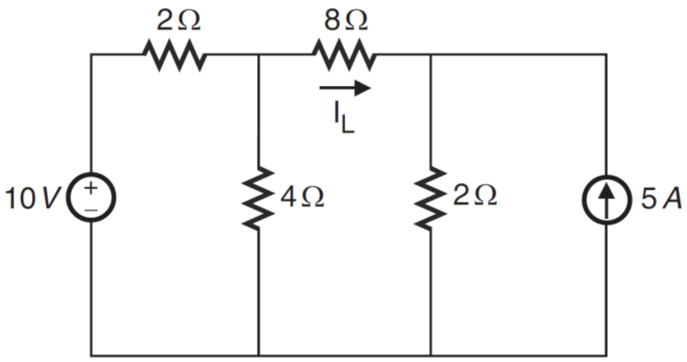
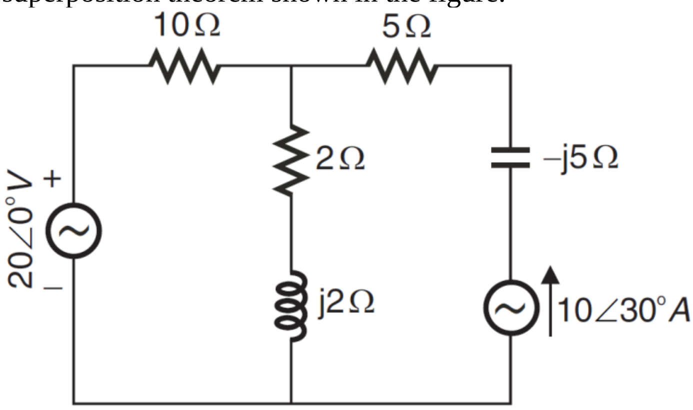
UNIT V

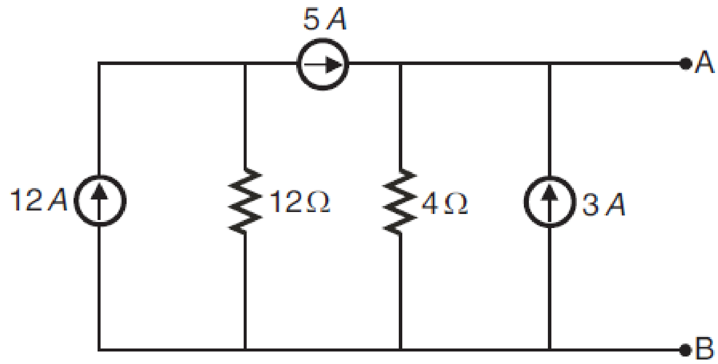
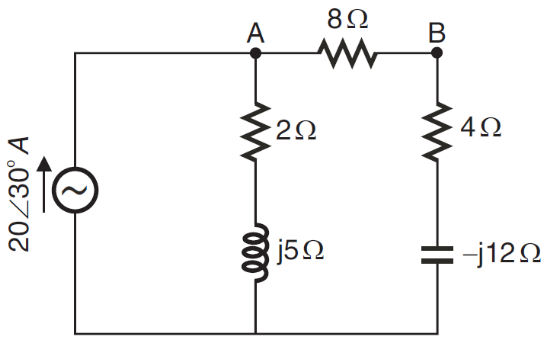
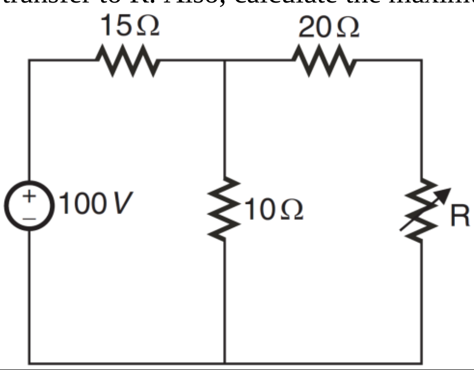
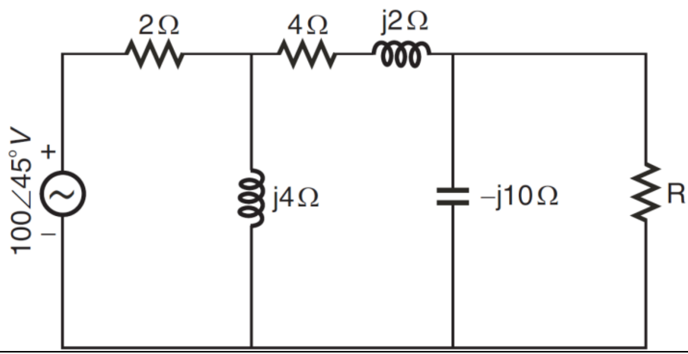
NETWORK THEOREMS (DC & AC EXCITATIONS)

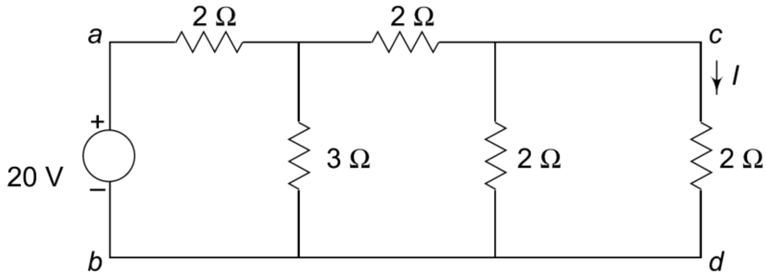
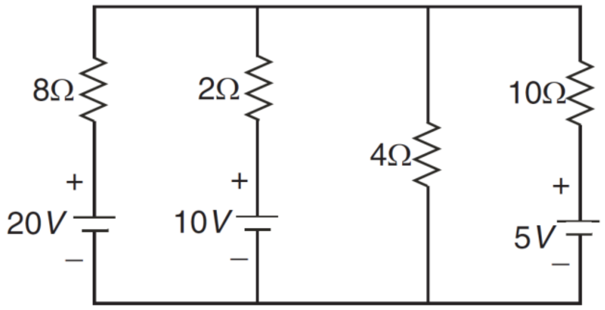
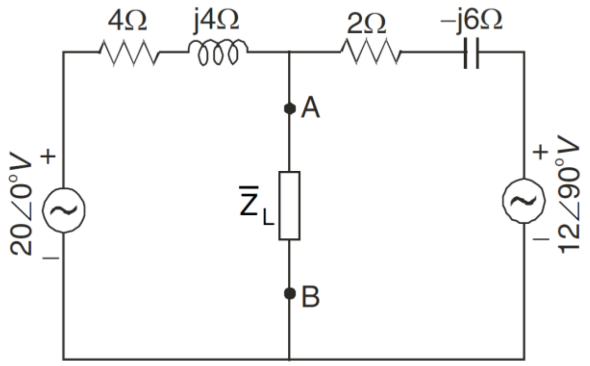
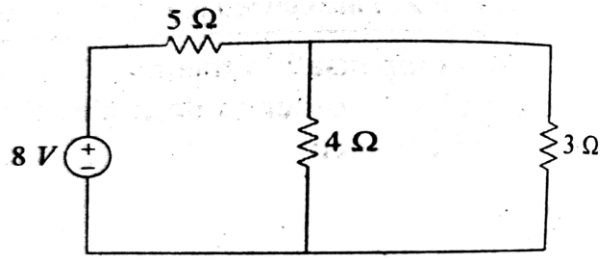
PART-A (2 MARKS)

1.	State superposition theorem.	**[L2][CO5]**	**[2M]**
2.	What is the property of additivity and homogeneity?	**[L1][CO5]**	**[2M]**
3.	**Find Thevenin's voltage across terminals A and B in the circuit shown in figure.** 	**[L2][CO5]**	**[2M]**
4.	Draw the equivalent circuit of Norton's Theorem and Thevenin's theorem.	**[L1][CO5]**	**[2M]**
5.	What is the current formula for the Maximum power transfer theorem and load current in Norton's Theorem?	**[L1][CO5]**	**[2M]**

PART-B (10 MARKS)

1.		Use the principle of superposition to find the current I_L in the 8Ω resistances of the circuit shown. 	**[L2][CO5]**	**[10M]**
2.		Find the current in each branch of the current at ac excitation using the superposition theorem shown in the figure. 	**[L2][CO5]**	**[10M]**

3.		Determine the Thevenin's and Nortons's equivalent of the circuit shown in the circuit below. 	**[L4][C05]**	**[10M]**
4.		Determine the voltage terminals A and B at ac excited circuit as shown in the figure by Norton's theorem. 	**[L4][CO5]**	**[10M]**
5.		In the circuit shown, find the value of adjustable resistor R for maximum power transfer to R. Also, calculate the maximum power. 	**[L2][CO5]**	**[10M]**
6.		Determine the AC excited circuit shown for the value of R so that the maximum power is transferred to it. 	**[L4] [CO5]**	**[10M]**

7.		Verify the reciprocity theorem for the network shown in the circuit. 	**[L2][CO5]**	**[10M]**
8.	(a)	State Milliman's theorem and derive an expression for Milliman's equivalent source of n number of parallel connected voltage sources.	**[L2][CO5]**	**[4M]**
	(b)	Using Millman's theorem, find current through 4Ω resistance for the following circuit. 	**[L4][CO5]**	**[6M]**
9.		In an AC excited circuit shown, apply Millman's theorem to find Thevenin's equivalent at A-B. Hence, find $\overline{Z_L}$ for maximum power transfer. 	**[L3][CO5]**	**[10M]**
10.		In the circuit shown, the 3Ω resistance is changed to 6Ω resistance. Using the compensation theorem find the change in current in 5Ω resistance. 	**[L2][CO5]**	**[10M]**

Prepared By: DR. M. PRIYA