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)

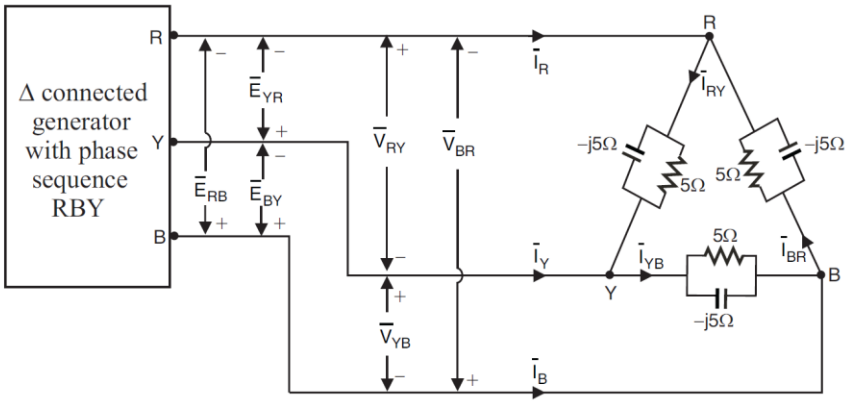
Subject with Code : ELECTRICAL CIRCUIT ANALYSIS-II (23EE0208)
Course & Branch: B. Tech –EEE
Year & Semester: II - B. Tech. & I-Semester **Regulation:** R23

UNIT I
ANALYSIS OF THREE PHASE BALANCED CIRCUITS
ANALYSIS OF THREE PHASE UNBALANCED CIRCUITS
PART-A (2 MARKS)

1.	**What is balanced voltage and balanced impedance?**	**[L1][CO1]**	**[2M]**
2.	**What is phase sequence? Distinguish between unbalanced source and unbalanced load.**	**[L3][CO1]**	**[2M]**
3.	**Write the relation between the line and phase values of voltage and current in a balanced star connected source/load.**	**[L2][CO1]**	**[2M]**
4.	**delta-connected load has 30 − j40 W impedance per phase. Determine the line current if it is connected to 415 V, 3 φ , 50 Hz supply.**	**[L3][CO1]**	**[2M]**
5.	**A star-connected load has 6 + j8 W impedance per phase. Determine the line current if it is connected to 400 V, 3φ, 50 Hz supply.**	**[L3][CO1]**	**[2M]**

PART-B (10 MARKS)

1.		Discuss in detail the three phase 4-wire circuits with star connected balanced loads and power consumed by a balanced star-connected load.	**[L2][CO1]**	**[10M]**
2.		A balanced star-connected load of impedance 15 + j20 Ω per phase is connected to a three-phase, 440 V, 50Hz supply. Find line currents and power absorbed by the load. Assume the RYB sequence. Draw the phasor diagram.	**[L3][CO1]**	**[10M]**
3.		A three-phase balanced delta-connected load of 4 + j8 Ω is connected across a 400 V, three-phase balanced supply. Determine the phase currents and line currents. Assume the phase sequence to be RYB. Also, calculate the power drawn by the load. Sketch the phasor diagram.	**[L3][CO1]**	**[10M]**
4.		Discuss in detail the three phase 4-wire circuits with star connected for Unbalanced loads.	**[L2][CO1]**	**[10M]**
5.		A symmetrical three-phase, 100 V , three-wire supply feeds an unbalanced star-connected load with impedances of the load as $\bar{Z}_R = 5\angle 0°\Omega, \bar{Z}_Y = 2\angle 90°\Omega$ and $\bar{Z}_B = 4\angle -90°\Omega$. Find the line currents, voltage across the impedances and the displacement neutral voltage. Also calculate the power consumed by the load. Sketch the phasor diagram.	**[L3][CO1]**	**[10M]**
6.		A delta-connected generator with phase sequence of RBY is connected to a deltaconnected load with phase sequence RYB as shown in Fig. 1. Determine the voltages of generator and load by taking $\bar{V}_{RY} = 120\angle 0°$V. Also calculate the phase and line currents of the load.	**[L3][CO1]**	**[10M]**

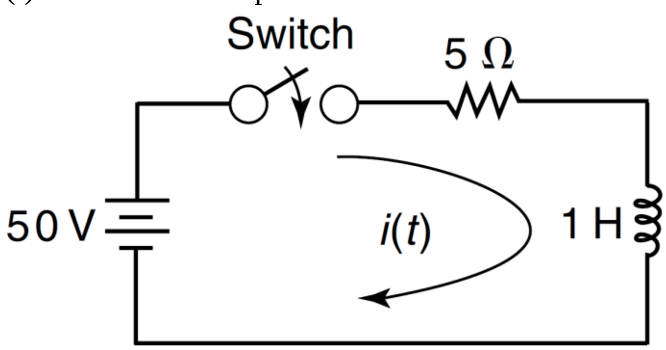


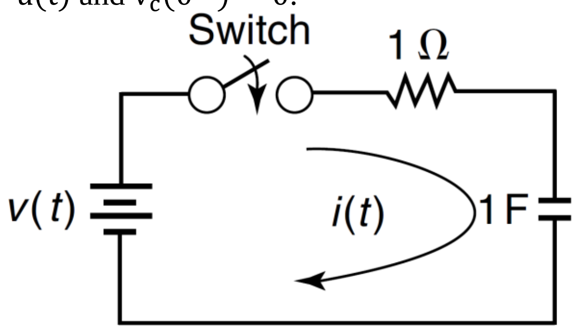
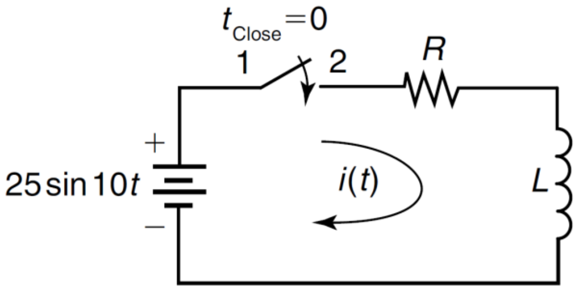
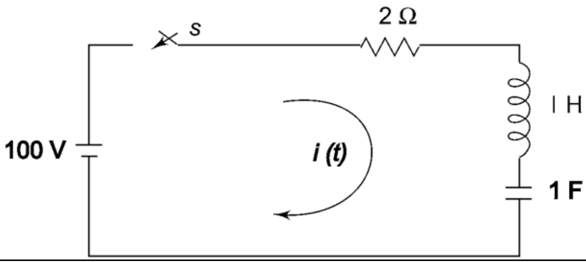
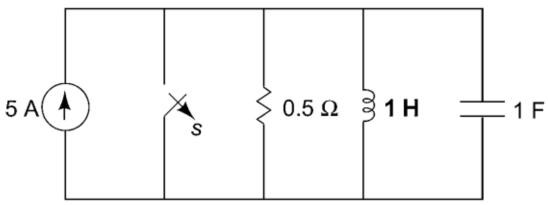
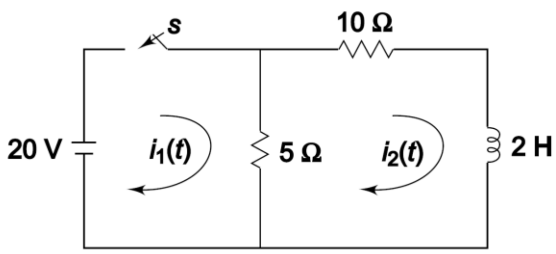
7.	**(a)**	A symmetrical three-phase, three wire, 400 V supply is connected to a delta-connected load. Impedance in each branch are $\bar{Z}_{\mathrm{RY}} = 10\angle 30°\Omega, \bar{\mathrm{Z}}_{\mathrm{YB}} = 10\angle 45°\Omega$ and $\bar{\mathrm{Z}}_{\mathrm{BR}} = 2.5\angle 60°\Omega$. Find its equivalent star-connected load.	**[L1][CO1]**	**[5M]**
	(b)	A symmetrical three-phase three wire 440 V supply is connected to a star-connected load. The impedance in each branch is $\bar{Z}_R = 2 + \mathrm{j}3\Omega, \bar{Z}_Y = 1 - \mathrm{j}2\Omega$ and $\bar{Z}_B = 3 + \mathrm{j}4\Omega$. Find its equivalent delta connected load.	**[L3][CO1]**	**[5M]**
8.		Show that three-phase power can be measured by two wattmeters. Draw the phasor diagrams. Derive an expression for power factor in terms of wattmeter readings.	**[L1][CO1]**	**[10M]**
9.		Each of two wattmeters connected to measure the power input to a three-phase circuit read 10 kW on a balanced load, when the power factor is unity. What does the instrument read when the power factor falls to i) 0.866 lagging, and ii) 0.5 lagging, the total three-phase power remaining unaltered?	**[L4][CO1]**	**[10M]**
10	**(a)**	The power input to a three-phase induction motor is read by two wattmeters. The readings are 1000 W and 500 W. Find out the pf of the motor. If the line voltage is 400 V, find the line current.	**[L3][CO1]**	**[5M]**
	(b)	Two wattmeters are connected to measure power in a 3-phase network. The two readings are 2000 W and 1000 W respectively. If another wattmeter be connected such that its current coil is in one phase and the potential coil is across the other two phase terminals, what will it read? Also estimate the reactive power of the network.	**[L4][CO1]**	**[5M]**

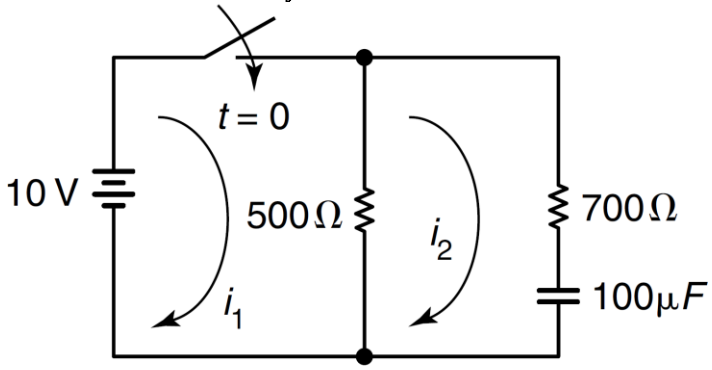
UNIT II
LAPLACE TRANSFORMS AND TRANSIENT ANALYSIS
PART-A (2 MARKS)

1.	**Find the Laplace transform of exponential function $f(t) = e^{at}$.**	**[L4][CO2]**	**[2M]**
2.	**Determine the Laplace transform of unity, that is, $f(t) = 1$.**	**[L2][CO2]**	**[2M]**
3.	**What is the time constant of an RC circuit?**	**[L1][CO2]**	**[2M]**
4.	**An RLC series circuit with R = 10 Ω and L = 2 H. Determine the value of C to give critical damping.**	**[L2][CO3]**	**[2M]**
5.	**An RLC series circuit with R = 5 Ω is excited by a dc source of 10 V by closing the switch at t = 0. Draw the initial and final conditions of the circuit.**	**[L3][CO3]**	**[2M]**

PART-B (10 MARKS)

1.		Define Laplace transform of standard function and find Laplace transform of standard function for the following. i. Evaluate $L[3e^{-5t} + 8\cos\ 3t + 2\sinh\ 2t - 5t^3]$ ii. Evaluate L[sin 2t cos 3t]	**[L1][CO2]**	**[10M]**
2.		Derive shifting theorem of Laplace transform. i. Find the Laplace transform of $e^{at}\sin bt$. ii. Find the Laplace transform of $(t+2)^2e^t$. iii. If $u(t) = 1$, for $t \geq 0$ and $u(t) = 0$ for $t < 0$, determine the Laplace transform of $[u(t) - u(t-a)]$.	**[L4][CO2]**	**[10M]**
3.	**(a)**	Derive a differentiation of Laplace transform and find the Laplace transform of function $f(t) = t\sin\ 2t$.	**[L3][CO2]**	**[5M]**
	(b)	Derive an integration of Laplace transform and solve the equation for the response $i(t)$, given that $\frac{di}{dt} + 2i + 5\int_0^t idt = u(t)$ and $i(0) = 0$.	**[L3][CO2]**	**[5M]**
4.	**(a)**	Define of Inverse Laplace Transform and find the function $f(t)$ If $F(s) = \frac{2}{(s+1)(s+5)}$.	**[L1][CO2]**	**[5M]**
	(b)	Evaluate $L^{-1}\left[\frac{s}{(s^2+1)(s^2+4)}\right]$	**[L2][CO2]**	**[5M]**
5.		Derive an expression for the step response in an R-L series circuit Excited by DC Supply and write the initial and final condition with characteristics.	**[L3][CO2]**	**[10M]**
6.	**(a)**	The series RL circuit shown in Figure is excited by a dc voltage of 50 V. Assume the initial current flowing through the inductor to be 5 A and find the current i(t) for t > 0. Use Laplace transform method.  	**[L3][CO3]**	**[6M]**

	(b)	Find the current $i(t)$ for the circuit shown in Figure, if the voltage source is $v(t) = 5e^{-2t}u(t)$ and $v_c(0-) = 0$.  	**[L1][CO3]**	**[4M]**
7.		A sinusoidal voltage 25sin10t is applied at time $\mathbf{t} = 0$ to a circuit as shown in Figure. Find the current i(t) by Laplace transform method. $R = 5\Omega$ and $L = 1H$.  	**[L1][CO3]**	**[10M]**
8.	**(a)**	For the circuit shown in Figure, determine the current in the circuit when the switch is closed at t=0. Assume that there is no initial charge on the capacitor or current in the inductor.  	**[L3][CO3]**	**[5M]**
	(b)	For the circuit shown in Fig. 13.12, find the voltage across the 0.5Ω resistor when the switch, s, is opened at $t = 0$. Assume there is no charge on the capacitor and no current in the inductor before switching.  	**[L3][CO3]**	**[5M]**
9.		For the circuit shown in Figure, determine the current in the 10Ω resistor when the switch is closed at $t = 0$. Assume initial current through the inductor is zero.  	**[L2][CO3]**	**[10M]**

10.		For the circuit shown in figure, find an expression for the current supplied by the source. How much time it will take for the current to reach 25 mA? Assume the circuit to be initially relaxed. 	**[L3][CO3]**	**[10M]**

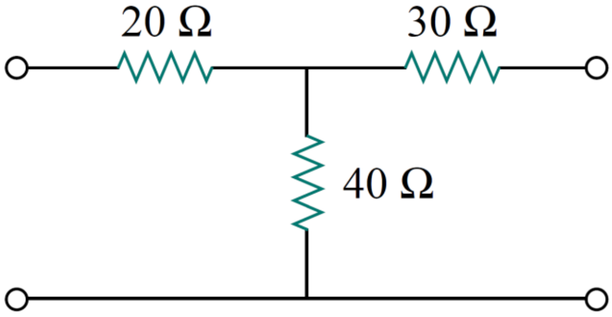
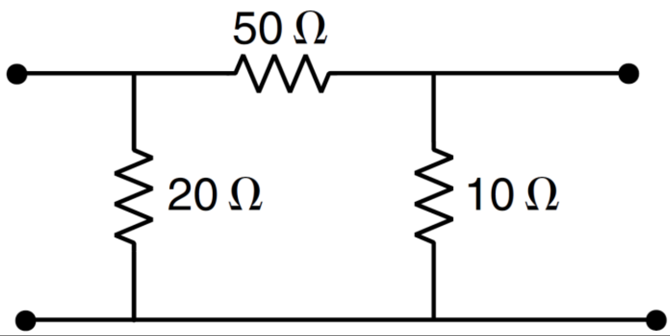
UNIT III

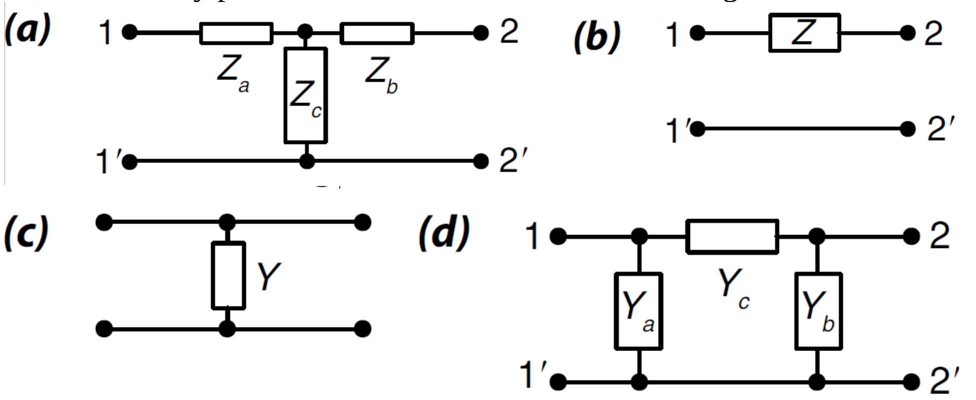
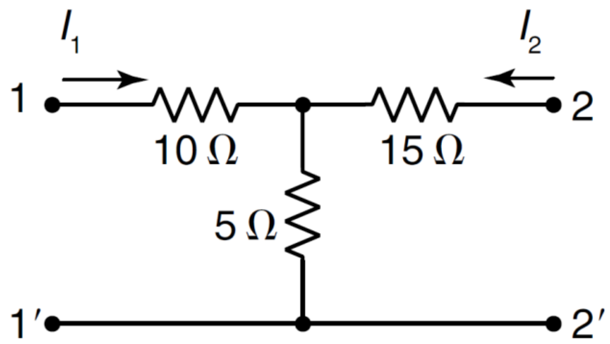
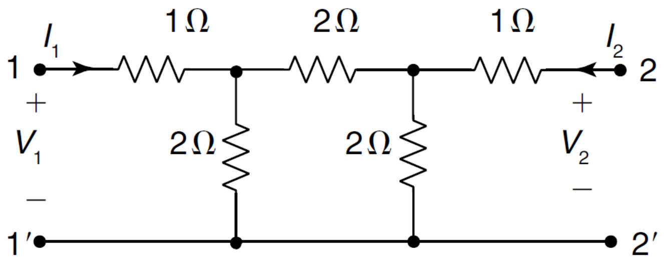
NETWORK PARAMETERS

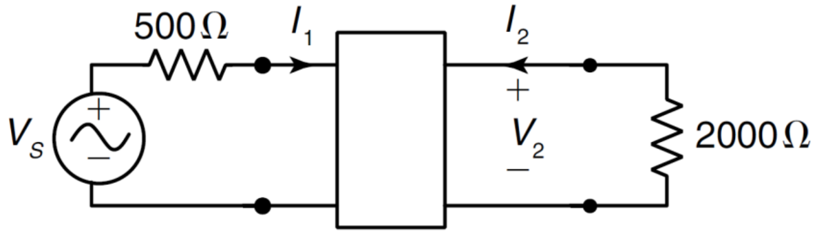
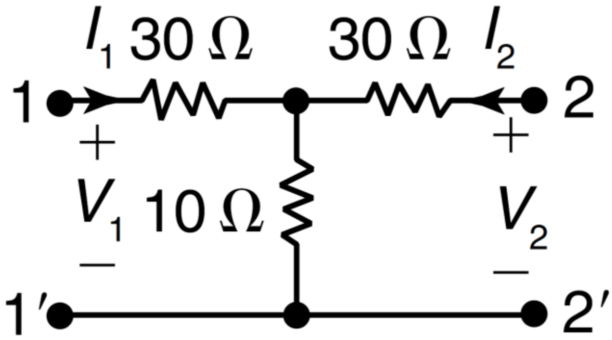
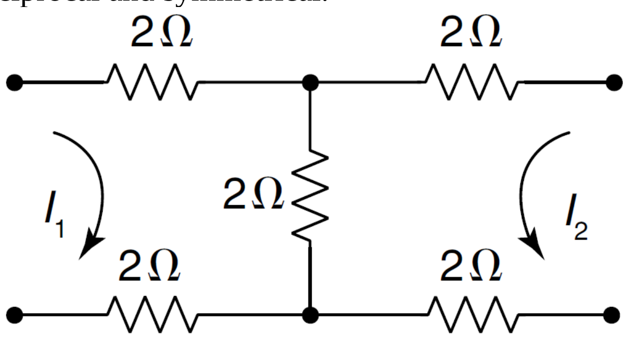
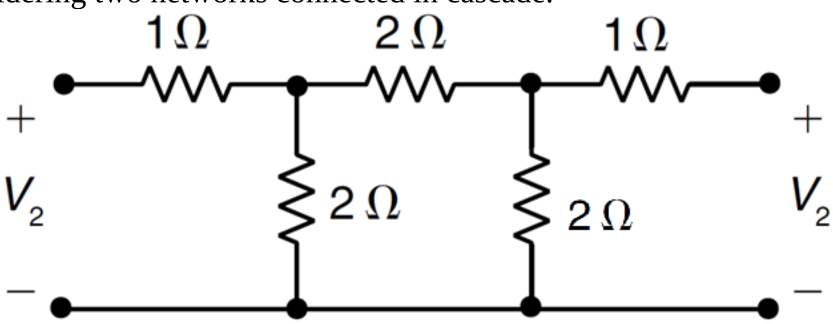
PART-A (2 MARKS)

1.	**What are the open-circuit impedance parameters of a two-port network?**	**[L1][CO4]**	**[2M]**
2.	**Define y-parameters.**	**[L1][CO4]**	**[2M]**
3.	**Why are the ABCD parameters termed transmission parameters?**	**[L1][CO4]**	**[2M]**
4.	**What are transmission parameters? Where are they most effectively used?**	**[L1][CO4]**	**[2M]**
5.	**How will you find the π-equivalent of a given network when its y-parameters are known?**	**[L1][CO4]**	**[2M]**

PART-B (10 MARKS)

1.		Define z and y parameters of a typical four-terminal network. Determine the relationship between the z and y parameters.	**[L2][CO4]**	**[10M]**
2.	**(a)**	Determine the z-parameters for the network shown in Figure. 	**[L2][CO4]**	**[6M]**
	(b)	Find the y-parameters for the network shown in Figure. 	**[L4][CO4]**	**[4M]**

3.		Find the z and y parameter for the networks shown in Figure. 		**[L4][CO4]**	**[10M]**
4.	**(a)**	(i)	Develop an equation for Hybrid Parameters (h-Parameters) and Inverse Hybrid Parameters (g-Parameters).	**[L2][CO3]**	**[6M]**
		(ii)	Find the hybrid parameters for the network shown in Figure. 		
	(b)	Determine the h -parameter with the following data: (i) with the output terminals short-circuited, $V_1 = 25$ V, $I_1 = 1$ A, $I_2 = 2$ A (ii) with the input terminals open-circuited, $V_1 = 10$ V, $V_2 = 50$ V, $I_2 = 2$ A		**[L2][CO4]**	**[4M]**
5.	**(a)**	Derive the equation for Transmission Parameters (ABCD-Parameters) and Inverse Transmission Parameters (ABCD -Parameters)		**[L3][CO4]**	**[4M]**
	(b)	For the network shown Figure, determine the ABCD parameters. 		**[L3][CO4]**	**[6M]**
6.	**(a)**	Express Z-parameters in terms of Hybrid-parameters and ABCD parameters for a two-port network.		**[L4][CO4]**	**[5M]**
	(b)	The h-parameters of a two-port network shown in Figure are $h_{11} = 1000\Omega$, $h_{12} = 0.003$, $h_{21} = 100$, and $h_{22} = 50 \times 10^{-6}$mho. Find V_2 and z -parameters of the network if $V_s = 10^{-2}\angle 0°(V)$.		**[L2][CO4]**	**[5M]**

				
7.	**(a)**	For the symmetrical two-port network, calculate the z-parameters, y-parameters, Hybrid parameters and ABCD-parameters for the given network and state whether the network is reciprocal and symmetrical. 	**[L4][CO4]**	**[6M]**
	(b)	Find the z-parameters for the network shown in Figure and state whether the network is reciprocal and symmetrical. 	**[L1][CO4]**	**[4M]**
8.	**(a)**	Two two-port networks are connected in parallel. Prove that the overall y-parameters are the sum of corresponding individual y-parameters.	**[L4][CO4]**	**[5M]**
	(b)	Two two-port networks are connected in series. Prove that the overall z-parameters are the sum of corresponding individual z-parameters.	**[L4][CO4]**	**[5M]**
9.	**(a)**	Two two-port networks are connected in cascade. Prove that the overall transmission parameter matrix is the product of individual transmission parameter matrices.	**[L4][CO4]**	**[5M]**
	(b)	Find the transmission parameters for the network shown in Figure considering two networks connected in cascade. 	**[L3][CO4]**	**[5M]**

<table>
<tr>
<td>10.</td>
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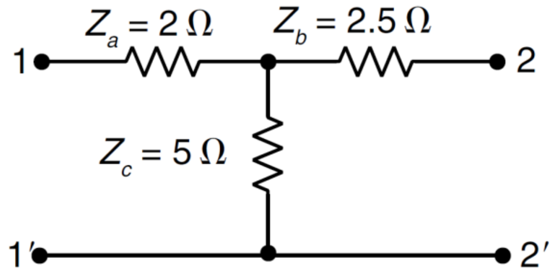
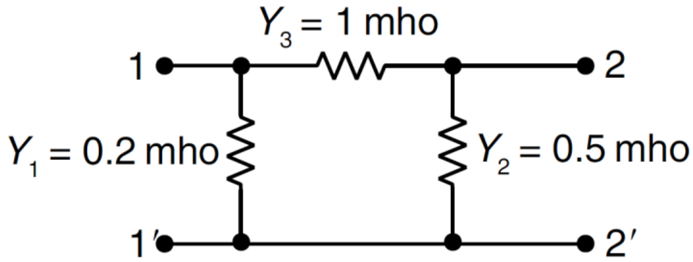
<td>Find the equivalent networks for the following.
(a) Equivalent π-network for the T-network shown in Figure (a).


(a)
(b) Equivalent T -network for the -network shown in Figure (b).


(b)</td>
<td>[L3][CO4]</td>
<td>[10M]</td>
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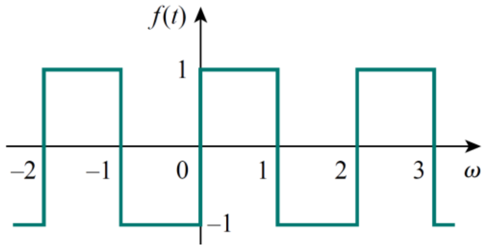
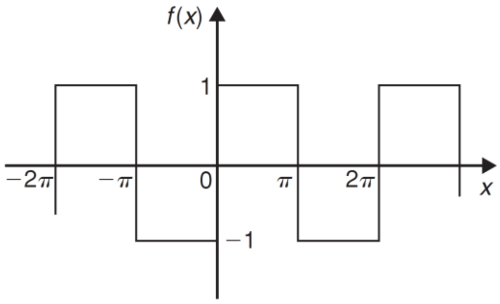
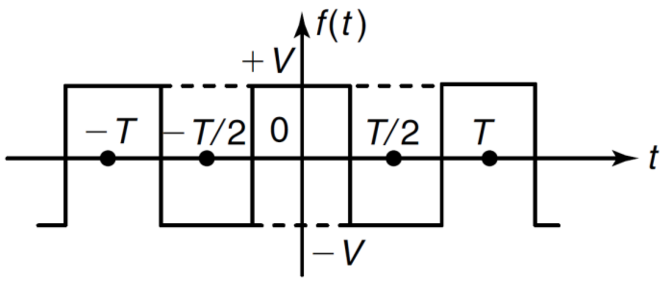
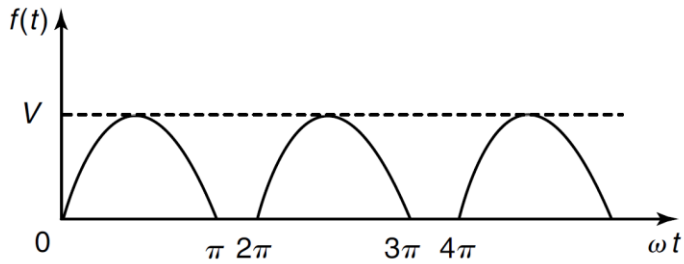
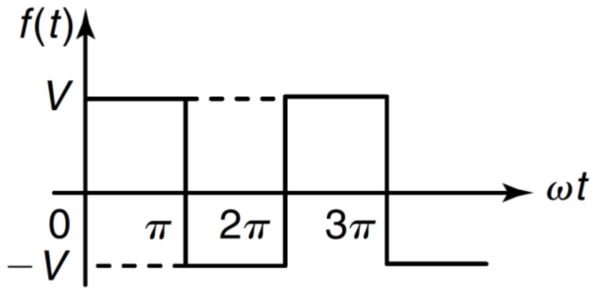
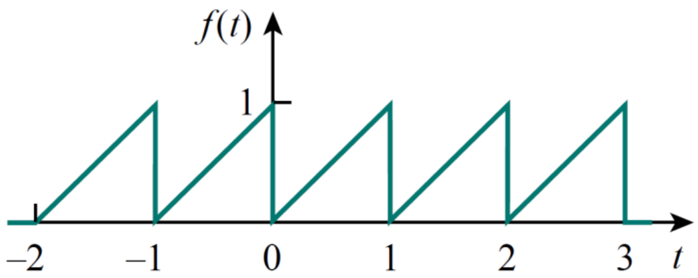
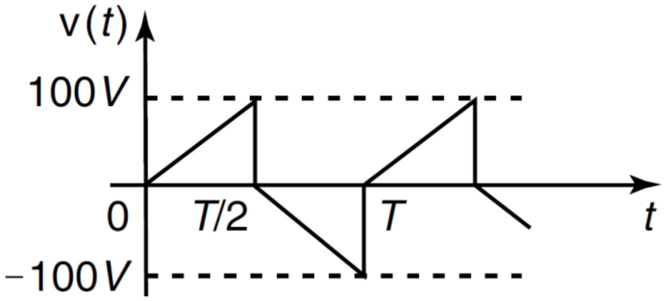
UNIT IV
ANALYSIS OF ELECTRIC CIRCUITS WITH PERIODIC EXCITATION
PART-A

(2 MARKS)

1.	**What are the conditions which a periodic function must satisfy to have its Fourier series expansion?**	**[L1][CO5]**	**[2M]**
2.	**Find the Fourier series of the square wave in Figure. Plot the amplitude and phase spectra.** 	**[L3][CO5]**	**[2M]**
3.	**Write the steps for application of Fourier transform to circuit analysis.**	**[L1][CO5]**	**[2M]**
4.	**Write the equation for an alternative to the trigonometric (or sine-cosine) Fourier series.**	**[L1][CO5]**	**[2M]**
5.	**Determine the Fourier coefficients.**	**[L1][CO5]**	**[2M]**

PART-B (10 MARKS)

1.		Define Fourier series and determine the evaluation of Fourier coefficient from the square wave function as shown in figure. 	**[L2][CO5]**	**[10M]**
2.		Show that the Fourier series expansion of a periodic function with odd (rotation) symmetry contains only the sine terms and even (mirror) symmetry contains only the cosine terms plus a constant.	**[L1][CO5]**	**[10M]**
3.		Determine the Fourier series for the square waveform shown below and plot the magnitude and the phase spectra. 	**[L4][CO5]**	**[10M]**
4.		Find the trigonometric Fourier series for the half-wave rectified sinewave shown in Figure and sketch the spectrum.	**[L3] [CO5]**	**[10M]**

				
5.		For the periodic function shown in Figure, determine the exponential form of Fourier series and show the line spectra. Also, find its trigonometric form. 	**[L3][CO5]**	**[10M]**
6.		Stipulate the complex Fourier series for periodic waveform.	**[L4][CO5]**	**[10M]**
7.		Find the complex Fourier series of the sawtooth wave in Fig. Plot the amplitude and the phase spectra. 	**[L2][CO5]**	**[10M]**
8.		Derive an expression for the effective value (RMS) and average value of a non-sinusoidal periodic waveform.	**[L3][CO5]**	**[10M]**
9.		Calculate the impedance consisting of R and L and the power factor of a circuit whose expression for voltage and current are $v(t) = 250\sin 314t + 50\sin(942t + 30°)(V)$, $i(t) = 17.7\sin(314t - 45°) + 1.583\sin(942t - 41.6°)(\mathrm{A})$	**[L2][CO5]**	**[10M]**
10.		Determine the Fourier series of repetitive waveform of Figure shown up to 5^{th} harmonic, when time of repetition, T = 20 ms. Calculate the fundamental frequency current, where $R = 10$ ohms and $L = 0.0318H$ with voltage transform of the waveform. 	**[L2][CO5]**	**[10M]**

UNIT V

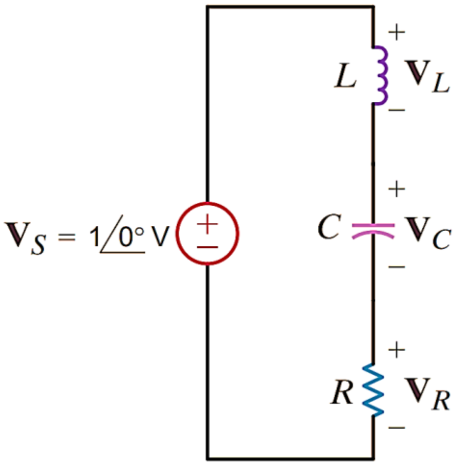
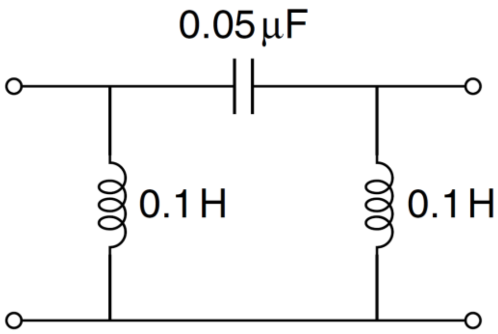
FILTERS

PART-A (2 MARKS)

1.	**What is a filter? Classify them.**	**[L2][CO6]**	**[2M]**
2.	**Draw the frequency response characteristics of a band pass filter and indicate the important frequencies in it.**	**[L3][CO6]**	**[2M]**
3.	**Write the characteristic equations of T and Π network?**	**[L1][CO6]**	**[2M]**
4.	**Draw constant-k low pass filter and high pass filter.**	**[L3][CO6]**	**[2M]**
5.	**A band-pass filter has a resonant frequency of 950 Hz and a bandwidth of 2700 Hz. Find its lower and upper cut-off frequencies.**	**[L2][CO6]**	**[2M]**

PART-B (10 MARKS)

1.	**(a)**	Design the **low pass RC filter** and illustrate the frequency-phase response curve.	**[L1][CO6]**	**[5M]**
	(b)	A simple low-pass RC filter having a cutoff frequency of 1 kHz is connected to a constant ac source of 10 V with variable frequency. Calculate the following: (a) value of C if $R = 10\text{k}\Omega$ (b) output voltage and its decibel level when (i) $f = f_c$ (ii) $f = 2f_c$ and (iii) $f = 10f_c$.	**[L1][CO6]**	**[5M]**
2.	**(a)**	Design the **low pass RL filter** and illustrate the frequency-phase response curve.	**[L1][CO6]**	**[5M]**
	(b)	An ac signal having constant amplitude of 10 V but variable frequency is applied across a simple low-pass RL circuit with a cutoff frequency of $1\ kHz$. Calculate (a) value of L if $R = 1\ k\Omega$ (b) output voltage and its decibel level when (i) $f = f_c$ and (ii) $f = 10f_c$.	**[L3][CO6]**	**[5M]**
3.	**(a)**	Design the **high pass RC filter** and illustrate the frequency-phase response curve.	**[L1][CO6]**	**[5M]**
	(b)	Design the **high pass RL filter** and illustrate the frequency-phase response curve.	**[L1][CO6]**	**[5M]**
4.		Design a high-pass RL filter that has a cutoff frequency of 4 kHz when $R = 3\ k\Omega$. It is connected to a $10\angle\ 0°\ V$ variable frequency supply. Calculate the following: (a) Inductor of inductance L but of negligible resistance (b) output voltage V0 and its decibel decrease at (i) $f = 0$ (ii) $f = f_c$ (iii) $8\ kHz$ and (iv) $40\ kHz$	**[L4][CO6]**	**[10M]**
5.	**(a)**	Explain in the detail with neat illustration of **bandpass Filter** network**.**	**[L2][CO6]**	**[5M]**
	(b)	Define Band Elimination Filter. Derive the operational characteristics of a band elimination filter.	**[L1][CO6]**	**[5M]**
6.		Consider the frequency-dependent network in Figure. Given the following circuit parameter values: $L = 159\mu\text{H}, C = 159\mu\ \text{F}$, and $R = 10\Omega$, let us demonstrate that this one network can be used to produce a low-pass, high-pass, or band-pass filter.	**[L3][CO6]**	**[10M]**

				
7.		A series-resonant band stop filter consist of a series resistance of $2k\Omega$ across which is connected a series-resonant circuit consisting of a coil of resistance 10Ω and inductance 350 mH and a capacitor of capacitance 181 pF. F if the applied signal voltage is $10\angle 0°$ of variable frequency, calculate (a) resonant frequency f_0; (b) half-power bandwidth B_{hp}; (c) edge frequencies f_1 and f_2; (d) output voltage at frequencies f_0, f_1 and f_2.	**[L3][CO6]**	**[10M]**
8.		Explain in the detail with neat illustrations the Constant-k filters of High pass and Low pass network and derive the network parameters.	**[L2][CO6]**	**[10M]**
9.	**(a)**	Design a constant K-type LPF having a cut-off frequency of 2000 Hz and a zero-frequency characteristic impedance of 200Ω. Draw T- and π-Section of the filter.	**[L3][CO6]**	**[5M]**
	(b)	A constant K-type LPF composed of T-section has 63.6 mH inductance in each series arm and 0.088 μF in the shunt arm. Find (1) cut-off frequency and (2) attenuation in β at 5000 Hz.	**[L2][CO6]**	**[5M]**
10.	**(a)**	Design a constant K-type HPF having a cut-off frequency of 5500 Hz and a design impedance of 750 Ω. Draw T-section filter and π-Section filter.	**[L3][CO6]**	**[5M]**
	(b)	Figure shows an HPF section. Find the cutoff frequency and characteristic impedance at $f = \infty$. 	**[L3][CO6]**	**[5M]**

Prepared By

DR. M. PRIYA