

Code No: R22029

R10 – Regular Students**SET - 1****II B. Tech II Semester Regular Examinations April/May – 2013****ELECTRICAL CIRCUITS ANALYSIS - II**

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

Answer any **FIVE** QuestionsAll Questions carry **Equal** Marks

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1. A symmetrical star-connected 3-phase load is made of three identical coils each having an internal resistance of  $12\Omega$  and inductance of  $142\text{ mH}$ . The power taken by this load when connected to a balanced 3-phase, 3-wire supply of  $400\text{V}$ ,  $50\text{ Hz}$  is measured by using the two watt-meter method. The watt-meters used are similar and are of type  $400\text{V}$ ,  $5\text{A}$ , UPF class 1 accuracy. i) Determine the expected readings of  $W_1$  and  $W_2$  and ii) Compute the total power
2. A balanced 3-phase system supplies an unbalanced delta connected load made of two resistors of  $100\Omega$  and  $200\Omega$  and a coil having an inductance of  $0.3\text{H}$  with negligible resistance. The line to line voltage is  $100\text{V}$  and the supply frequency is  $50\text{Hz}$ . Calculate: i) The total power in the system and ii) the total reactive power.
3. A source voltage of  $12\text{ V}$  is applied to series RL circuit at  $t = 0$  as shown in figure 1. Using Laplace Transform method, determine the circuit current  $i(t)$  for all  $t \geq 0$ . Assume zero initial conditions.

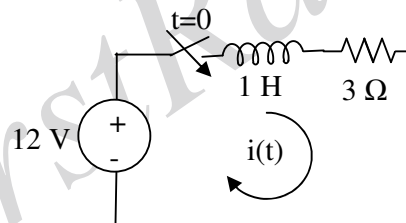


Figure 1

4. A series RC circuit has a sinusoidal voltage source  $v(t) = V_m \sin(\omega t + \phi)$  applied at time when  $\phi = 0$ . Find the expression for current.
5. The Z-parameters of a two-port network are  $Z_{11} = 15\Omega$ ,  $Z_{22} = 25\Omega$ ,  $Z_{12} = Z_{21} = 5\Omega$ . Determine i) ABCD parameters and also ii) The equivalent T-network.



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**SET - 1**

6. a) Synthesize the RC impedance function using Foster form I:  $Z(s) = \frac{4(s+2)(s+6)}{s(s+4)}$ .

b) Synthesize the impedance function  $Z(s) = \frac{(s^2 + 2)(s^2 + 4)}{s(s^2 + 3)(s^2 + 5)}$  using first form of Cauer network.

7. a) Determine the Fourier series for the saw tooth function shown in Figure 2.

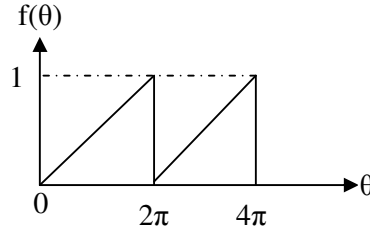


Figure 2

b) Determine the Fourier series expansion of the functions shown in below Figure 3.

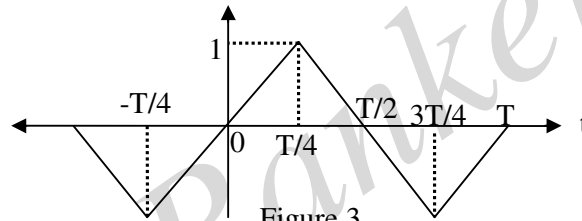


Figure 3

8. Find the response voltage in the network shown in Figure 4. Use Fourier transform method.

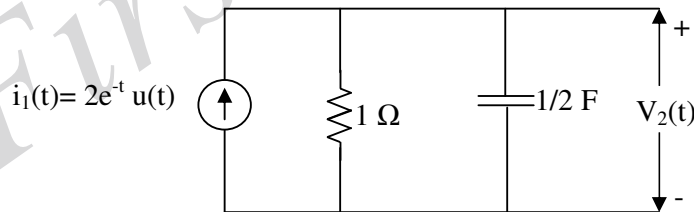
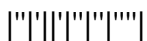


Figure 4



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1. A 3-phase system referred to as the Y-Y configuration having both the sources and the loads connected in the form of a Y. The following parameters are known:

Source voltage	$V_{SA} = 120\angle 0^\circ$ V(rms)
Source impedance	$Z_g = 0.05 + j0.15$
Load impedance	$Z_{Load} = 4 + j3$
Feeder impedance	$Z_{Line} = 0.1 + j0.2$

 (i) Compute I_A and V_{AN} (ii) Without further analysis state the values of I_B, I_C, V_{BN} and V_{CA}
 (iii) Find the line to line voltage V_{AB}, V_{BC} , and V_{CA} (iv) Find the total average power delivered to the loads.
2. a) A symmetrical three-phase 100V; three-wire supply feeds an unbalanced star-connected load, with impedance's of the load as $Z_R = 5\angle 0^\circ \Omega$, $Z_Y = 2\angle 90^\circ \Omega$ and $Z_B = 4\angle -90^\circ \Omega$. Find (i) Line currents (ii) Voltage across the impedances.
 b) The two-wattmeter method produces wattmeter readings $P_1 = 1560$ W and $P_2 = 2100$ W when connected to a delta-connected load. If the line voltage is 220 V, calculate: i) per-phase average power, ii) per-phase reactive power, iii) phase impedance.
3. a) In a series RL circuit, the application of a dc voltage results in a current of 0.741 times the final steady state value of current after 1 sec. However, after the current has reached its final value, the source is short circuited. What would be the value of the current after one second?
 b) In the figure 1 shown below $v(t) = 10$ V. Find $i_2(t)$ in the circuit. Assume all initial conditions to be zero. Use Laplace Transform technique.

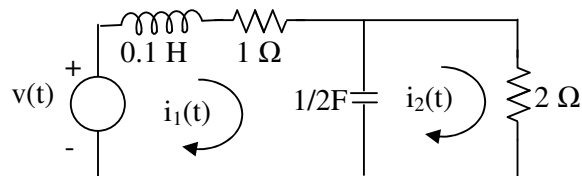


Figure 1

4. For the circuit shown below in figure 2, determine the transient current when the switch is moved from position 1 to 2 at $t = 0$. The circuit is in steady state with switch in position 1. The voltage applied to the circuit is $v(t) = 150 \cos(200t + 30^\circ)$ V.

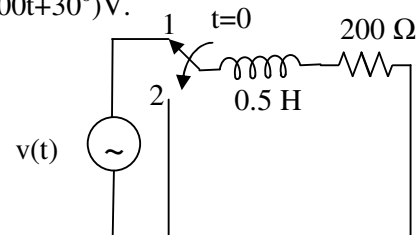


Figure 2



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5. Determine the Z-parameters and Y-parameters for the network shown below Figure 3.

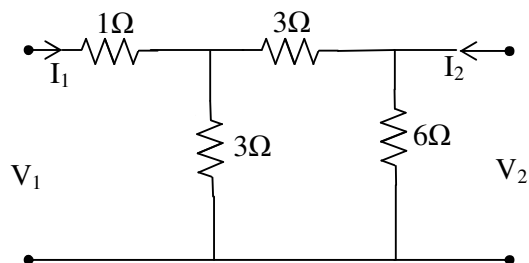


Figure 3

6. a) Synthesize the function $Z(s) = \frac{s(s^2 + 10)}{(s^2 + 4)(s^2 + 16)}$ using first Foster form of realization.

b) Synthesize the network in Cauer form I and II of the given function $Z(s) = \frac{2(s+1)(s+3)}{(s+2)(s+4)}$.

7. Find the Fourier series expansion of the waveform shown below figure 4.

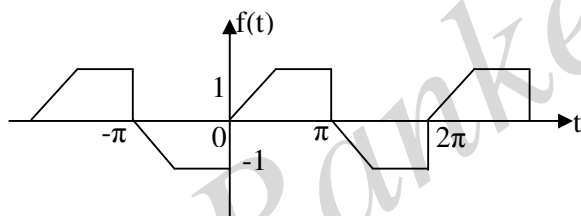


Figure 4

8. The current source in the figure 5 is $i(t) = 4e^{-t}$ for $t \geq 0$. Find the voltage V_0 using Fourier transform method.

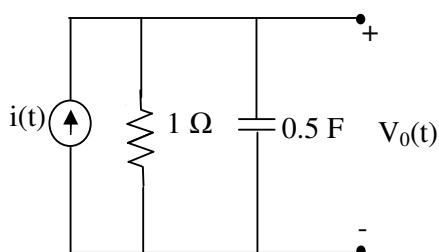


Figure 5



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1. A balanced 3-phase star-connected load of 210 kW takes a leading current of 160A when connected across a symmetrical 1.1 kV, 50Hz supply. Find the load circuit passive parameters per phase.
2. The following unbalanced star-connected impedances are connected to a 400V, three phase, system: $Z_R=j30\Omega$, $Z_Y=j3\Omega$, and $Z_B = -j3\Omega$, Calculate the line currents by using
i) Kirchoff's laws ii) Star-Delta conversion
3. A coil of resistance 12 Ω and inductance of 18 H is suddenly connected to a dc supply of 30V. calculate: (i) The initial rate of change of current (ii) The time constant (iii) The current after 3s (iv) The energy stored in the magnetic field during this time (v) The energy lost as heat during this time.
4. a) A sinusoidal voltage $v(t)=25 \sin 10t$ is applied at time $t = 0$ to a circuit as shown below fig 1, find the current $i(t)$ by Laplace transform method. Take $R = 5\Omega$ and $L = 1H$.

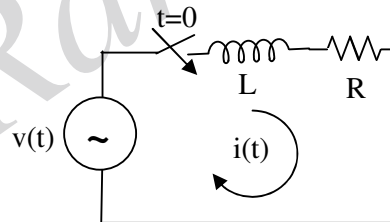
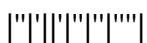


Figure 1

- b) A series RLC circuit, with $R = 5\Omega$, $L= 0.1H$, and $C = 500\mu F$, has a sinusoidal voltage source, $V=1000 \sin 250t$. Derive the expression for current and the resulting current if the switch is closed at $t=0$.



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5. a) A transfer function is given by $Z(s) = \frac{3s(s+4)}{(s+2)(s^2+s+1)}$ find its pole-zero plot.
 b) Find Z parameters for the two-port shown below Figure 2.

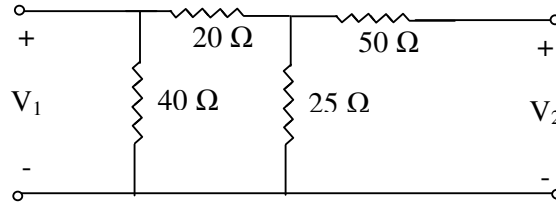


Figure 2

6. a) Using Foster form II, synthesize the function: $Y(s) = \frac{(s^2+5)(s^2+13)}{s(s^2+9)}$
 b) Synthesize the following LC impedance function $Z(s) = \frac{s(s^2+3)(s^2+5)}{(s^2+2)(s^2+4)}$ using Cauer form-II.

7. a) Determine the Fourier series in exponential form for the function shown below in Figure 4a.
 b) Find the trigonometric Fourier series of the waveform shown below in Figure 4b.

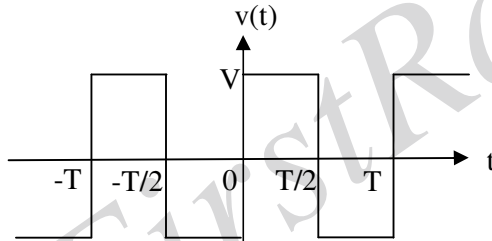


Figure 4a

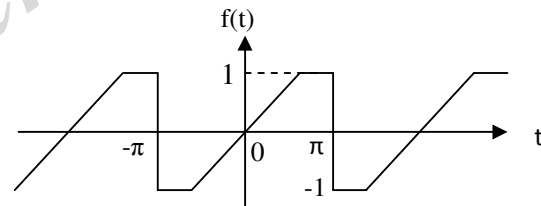


Figure 4b

8. Find the Fourier transform of the sine pulse shown in figure 5, and sketch the amplitude and phase spectra. If this voltage is applied to a series RL circuit with $R=1\ \Omega$ and $L=1.0\ \text{H}$, determine the amplitude and phase spectra for the resulting current $i(t)$.

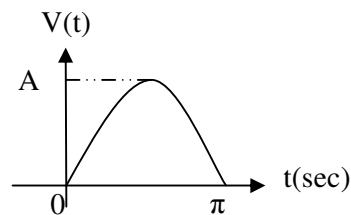
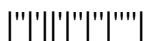


Figure 5



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- Three impedances  $Z_A$ ,  $Z_B$ , and  $Z_C$  are connected in delta to a 200V, 3-phase, 3-wire symmetrical system. The phase sequence is RYB.  $Z_A = 10\angle 60^\circ \Omega$  between lines R and Y;  $Z_B = 10\angle 60^\circ \Omega$  between lines B and R; and  $Z_C = 10\angle 0^\circ \Omega$  between line Y and B. The total power in the circuit is measured by means of two watt meters with their current coils in the lines R and B and their corresponding pressure coils across R and Y and B and Y respectively. Calculate the reading on each wattmeter and the total power supplied.
- A 3-phase, 3-wire CBA system supplies a  $\Delta$ -connected load in which  $Z_{AB} = 25\angle 90^\circ \Omega$ ,  $Z_{BC} = 15\angle 30^\circ \Omega$ ,  $Z_{CA} = 20\angle 0^\circ \Omega$ . Line voltage is 230V. Find the wattmeter reading when the two wattmeter method is used with meters in lines A and B.
- A series RC circuit consists of  $10\Omega$  and capacitor of 0.1 F as shown in fig. 1. A constant voltage of 20V is applied to the circuit at  $t = 0$ . Obtain the current equation. Determine the voltage across the resistor and the capacitor.

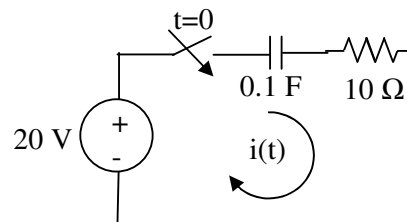


Figure 1

- For the circuit shown in fig. 2, determine the total current delivered by the source when the switch is closed at  $t = 0$ . Assume no initial charge on the capacitor.

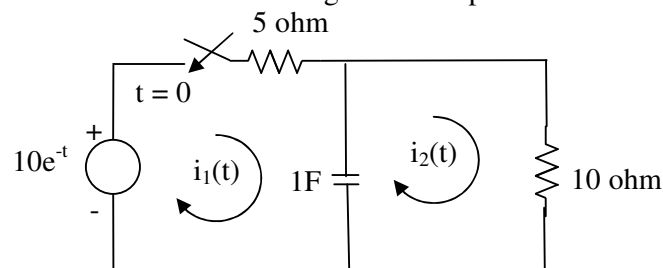


Figure 2

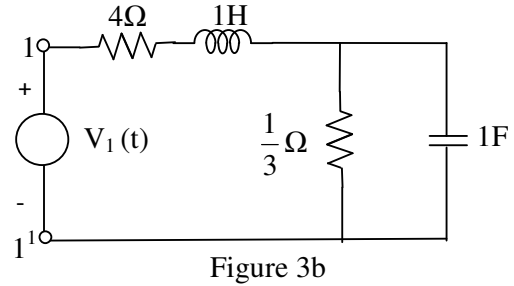
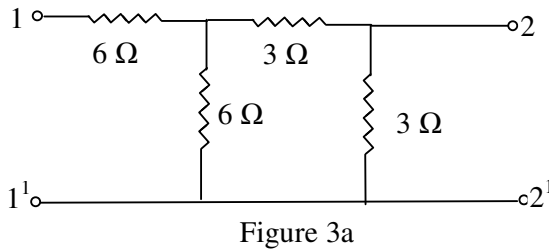


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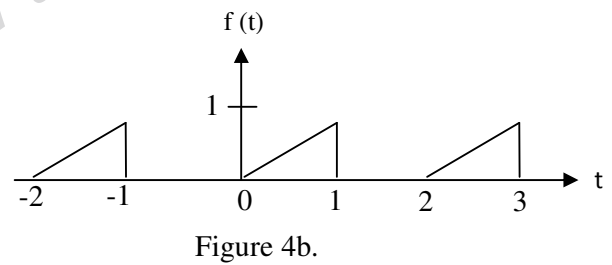
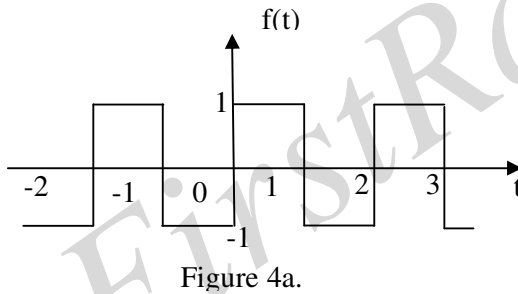
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5. a) Calculate the Y parameters for the two-port in Figure 3a.  
 b) Sketch the pole-zero plots of  $Z_{11}$  of the network shown below Figure 3b.



6. a) Synthesize the following function in Cauer form I and II.  $Z(s) = \frac{s^3 + 2s^2 + s + 1}{s^3 + s^2 + s}$   
 b) Using Foster form I, synthesize the function  $Z(s) = \frac{s(s^2 + 9)}{(s^2 + 5)(s^2 + 13)}$
7. a) Find the Fourier series of the square wave in figure 4(a). Plot the amplitude and phase spectra.  
 b) Obtain the Fourier series for the periodic function in Figure 4(b) and plot the amplitude and phase spectra.



8. a) Write the properties of Fourier transform and explain.  
 b) Determine the Fourier transform of the trapezoidal function shown below Figure 5.

