Code No: R22029 **R10** SET - 1

II B. Tech II Semester Regular/Supply Examinations August - 2014
ELECTRICAL CIRCUIT ANALYSIS - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) A balanced delta connected three phase load absorbs a complex power of 100kVA with a lagging power factor of 0.8 when the rms line to line voltage is 2400V. Calculate the impedance of each arm of the delta connected load.
   b) The three rms phase voltages of a balanced 3 ph supply are $V_{An} = 100\angle 0^0$, $V_{BAn} = 100\angle -120^0$ and $V_{Cn} = 100\angle -240^0$. What are the magnitudes of line voltages? If a balanced 3 phase star connected load of impedance $10\angle 30^0$ ohms per phase is connected to the supply, what are the line and phase currents. (8M+7M)

2. A delta connected load with impedance $Z_{AB} = 10\angle 30^0$ ohms, $Z_{BC} = 25\angle 0^0$ ohms, and $Z_{CA} = 20\angle -30^0$ ohms is connected to a three phase three wire 500V system. If the phase sequence is ABC, calculate the line currents and the total power. (15M)

3. Derive the expression for transient response in series R-L-C circuit for DC excitation. Obtain the solution using Laplace transforms. (15M)

4. In the Figure 1, determine complete solution for current, when switch K is closed at t = 0 for applied voltage *v* (t) 400 cos (500t+π/4). Derive the expression for the current. (15M)

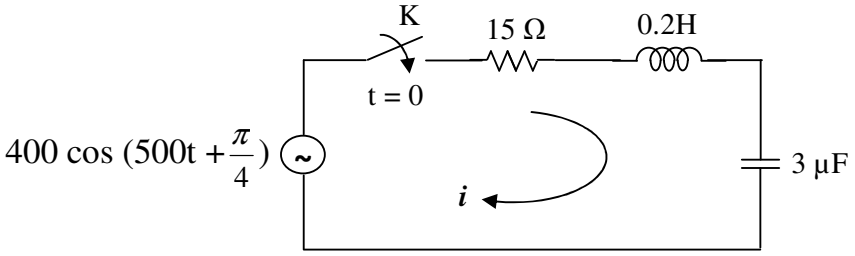

Figure 1
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5. a) Find the ABCD parameters for the following network in Figure 2

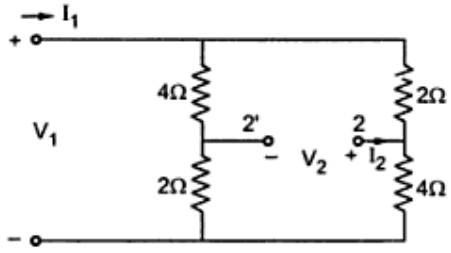

Figure 2

b) Explain about reciprocity and symmetry in h-parameter representation. (8M+7M)

6. a) Synthesize the impedance function $z(s)=\frac{s^4+8s^2+6}{s(s^2+3)}$ by Foster form I.

b) Determine where the function $F(s)=\frac{s^2+4}{s^3+3s^2+3s+1}$ is positive real or not. (8M+7M)

7. a) Determine the average power supplied to the circuit shown in Figure 3.

$i(t)=2+\cos(t+10^0)+6\cos(3t+35^0)A$

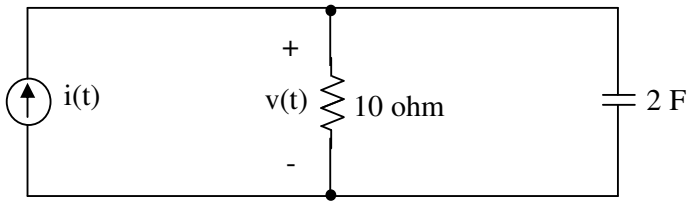

Figure 3

b) Find the Fourier series of a rectified half sine wave is defined over one period (9M+6M)
$f(t) = A \sin wt$ for $0 < t < T/2$ and $f(t) = 0$ for $T/2 < t < T$.

8. a) State and explain Fourier integral theorem.

b) Use the defining integral to find the Fourier transform of the following function (5M+10M)

$$f(t)=\begin{cases}-A & -\tau/2 \le t < 0\\ A & 0 < t \le \tau/2\\ 0 & \text{elsewhere}\end{cases}$$

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1. a) Prove that the line currents are equal to $\sqrt{3}$ times the phase currents in a delta connected system and they lag by 30^0 to the respective phase currents.
   b) Explain how reactive power can be measured in balanced three phase systems. (8M+7M)

2. A balanced 3 phase, 3 wire 50 Hz 100 volt supply is given to a load consisting of three impedances (1+i1), (1+j2) and (3+j4) ohms connected in star as shown in Figure 1. Compute the voltages across and currents in the three phases of the load using a) Milliman's theorem
   b) Loop current method. Phase sequence ABC. (15M)

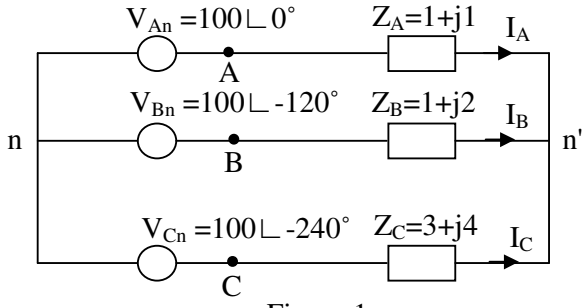

Figure 1

3. a) A series RC circuit consists of resistor of 10Ω and capacitor of 0.1F as shown in Figure 2. A constant voltage of 20V is applied to the circuit at t=0. Obtain the current equation. Determine the voltages across the resistor and the capacitor.
   b) In the Figure 3, determine the current i(t) when the switch is changed from position 1 to2 at t = 0. (8M+7M)

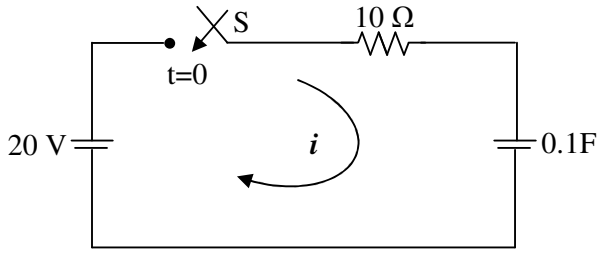

Figure 2

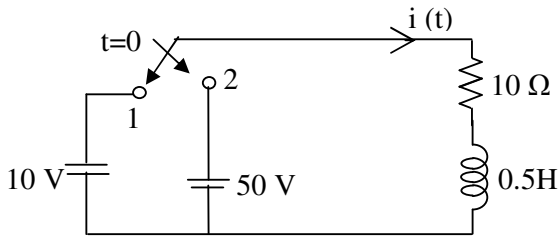

Figure 3

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4. Derive the complete solution for transient response in series R-L circuit for AC excitation (15M)

5. a) The z-parameters of a two port network are z_{11}=20Ω, z_{22}=30Ω, z_{12}=z_{21}=10Ω. Find Y and ABCD parameters.
   b) Derive the condition of reciprocity for ABCD-parameters. (10M+5M)

6. a) Find the Foster form II of the given function $\boldsymbol{Z(s)} = \dfrac{\boldsymbol{s}^2 + 8\boldsymbol{s} + 15}{\boldsymbol{s}^2 + 4\boldsymbol{s}}$

   b) Synthesize the RL driving point impedance by using Cauer second form $Z(s) = \dfrac{2s^2 + 8s + 4}{s^2 + 8s + 14}$ (7M+8M)

7. The circuit shown in Figure 4, has a non-sinusoidal $v_s(t)$ source that has Fourier series $v_s(t) = \frac{1}{2} + \frac{2}{\pi}\sum_{k=1}^{\infty}\frac{1}{n}\sin(n\pi t)$ for n = 2k -1. Find the voltage $v_o(t)$ at inductor and the corresponding amplitude spectrum. (15M)

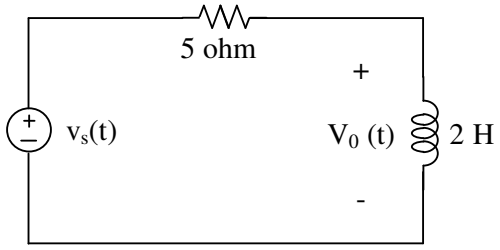

Figure 4

8. a) Determine the output voltage across the capacitor if the excitation is a current source $i(t) = e^{-t}\,u(t)$ in below Figure 5.

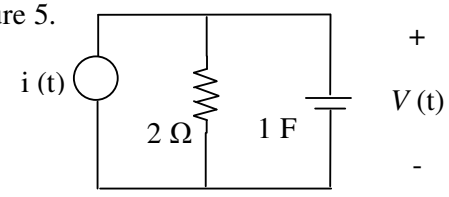

Figure 5

   b) Suppose the input given to a linear system is $v = 2e^{-t}\,u(t)$. Determine the response of the system (9M+6M)

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1. a) Three impedances each of 3-j4Ω are connected as shown in Figure 1 across a 3ph 230V balanced supply. Calculate the line and phase currents in the delta connected load.

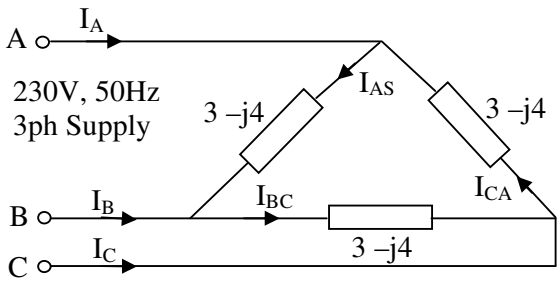

Figure 1

b) A balanced 3 ph load draws 100kW at a lagging power factor of 0.8 from a 400V 3 phase 50Hz main. Calculate the complex power and the line current. (9M+6M)

2. A three phase 4-wire 400volts a.c. system supplies a star connected load in which $\boldsymbol{Z}_A = 10\angle 0^0$ Ω, $\boldsymbol{Z}_B = 15\angle 30^0$ Ω, and $\boldsymbol{Z}_C = 10\angle -30^0$ Ω. The phase sequence is ABC. A wattmeter W_1 has its current coil in phase A and its pressure coil across A and B. Another wattmeter W_2 has its current coil in phase C and its pressure coil across B and C. Calculate the wattmeter readings and the current through the neutral wire. Also calculate the voltage between supply neutral and load neutral. (15M)

3. a) In an RL circuit of Figure 2, the switch closes at t = 0. Find the complete current response if R =10Ω, L=0.01H;
b) A 200Ω resistor is in series with an inductor L. The initial value of the inductor current is 5 mA and its value 5ms later is 3mA. Find the time constant and the inductance. (8M+7M)

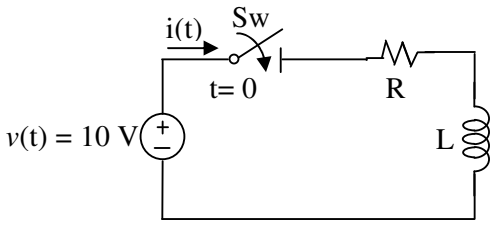

Figure 2
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4. In the Figure 3, determine complete solution for current, when switch K is closed at t = 0. For applied voltage is V(t) which is given as 100 cos (10^3t+π/2). Derive the expression for the current. (15M)

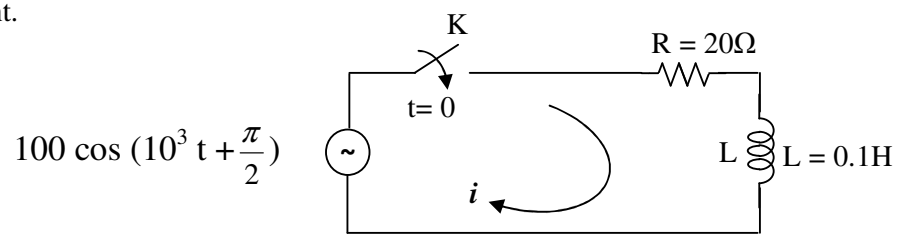

Figure 3

5. Find z-parameters for the given network shown in figure 4 using interrelations. (15M)

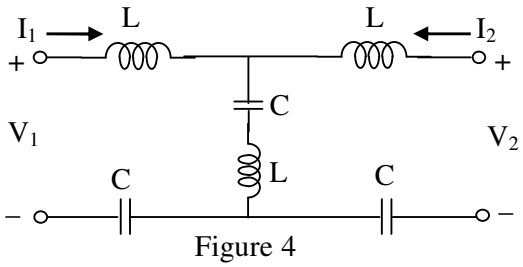

Figure 4

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

   b) Synthesize the LC impedance function $Z(s)=\frac{(s^2+1)(s^2+3)}{s(s^2+2)}$ in II cauer form.

7. a) Determine the complex Fourier series for the waveform shown in Figure 5.
   b) In a two-element series network voltage and current are given as
   v = 40+30 sin 314 t + 30 sin 942 t
   i = 8 sin (314 t +60^0) + 15 sin (942 t + 45^0)
   Determine the power consumed and the network elements.

8. a) Use the defining integral to find the Fourier transform of the following function

$$f(t)=\begin{cases}0 & t<0\\ te^{-at} & t\geq 0, a\end{cases}$$

   b) For the circuit shown in Figure 6, find v_0 (t) if v_0 (t) = 5 e^{-3t} u(t).

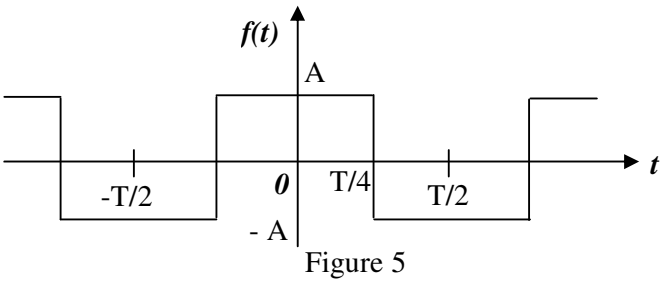

Figure 5

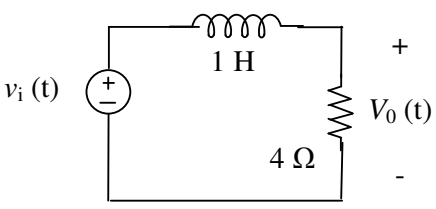

Figure 6

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1. a) A balanced three phase inductive load is connected to a balanced 3ph power system. The line voltage is 480V and the line current is 10A. The angle of the phase impedance of the load is 60^0. Find the complex power S and real power P absorbed by the load.
   b) Three inductors each of resistance 2 ohms and an inductive reactance of 8 ohms are connected in star and supplied from three phase 230V 50 Hz supply .What are the line and phase currents and voltages? Also calculate the power input and power factor. (7M+8M)

2. For the network of Figure 1, calculate the line currents and power consumed if a) the phase sequence is ABC and b) the phase sequence is ACB. (15M)

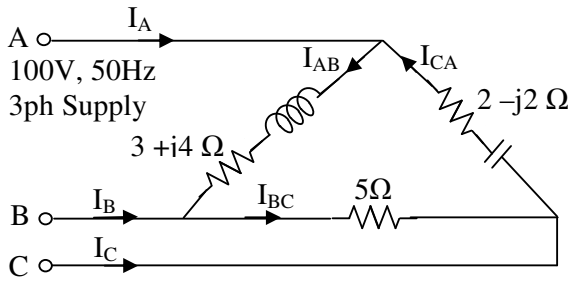

Figure 1

3. a) The circuit shown in Figure 2 consists of resistance, inductance and capacitance in series with a 100V constant source when the switch is closed at t=0. Find the current transient.
   b) In the circuit shown in Figure 3, obtain the equations for $i_1(t)$ and $i_2(t)$ when the switch is closed at t = 0 (7M+8M)

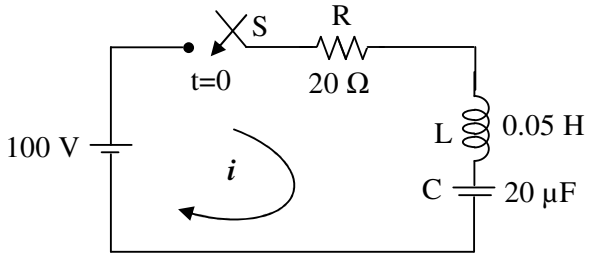

Figure 2

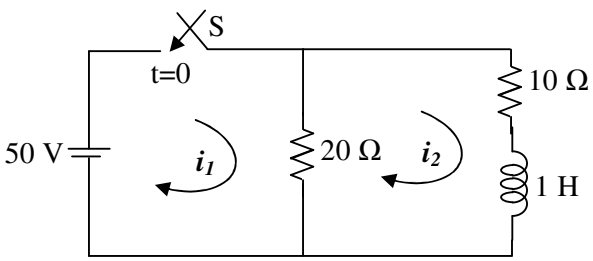

Figure 3

4. Derive the expression for transient response in series R-L-C circuit for AC excitation using Laplace transforms (15M)
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5. a) Derive z-parameters in terms of y and ABCD parameters.
   b) Determine h-parameters after writing transformed network for the given circuit in Figure.4 (10M+5M)

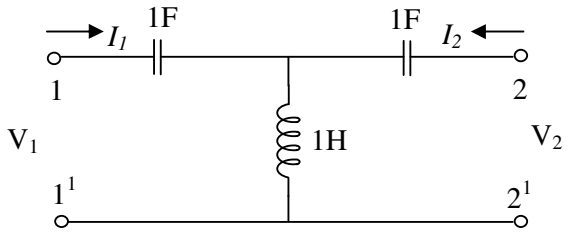

Figure 4

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

   b) Test whether the function $\left(\frac{s^2+1}{s^3+4s}\right)$ is positive real. (8M+7M)

7. Find the response $i_o(t)$ in the circuit shown in Figure 5 if the input voltage v(t) has the

   Fourier series expansion $v(t) = 1 + \sum_{n=1}^{\infty} \frac{2(-1)^n}{1+n^2}(\cos nt - n \sin nt)$ (15M)

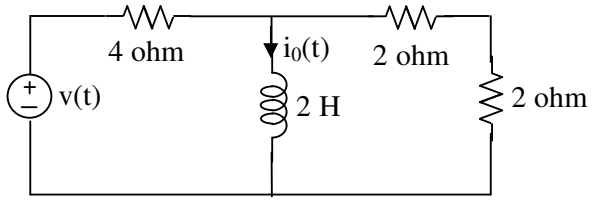

Figure 5

8. a) For the circuit shown in Figure 6, find v_0 (t) if v_i (t) = cos 2 t.

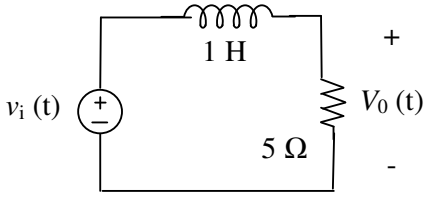

Figure 6

   b) List out any six properties of Fourier transform. (9M+6M)