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Circuit Theory – 1st year
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Time 3 Hours

Attempt the following.

1- For the circuit in Fig. 1, the current $i_{(t)}$ is shown in Fig.(2). Plot the variation of v_o with time. (10 pts)

2- Write the equations necessary to obtain the voltage v for the circuit in Fig. 3. (10 pts)

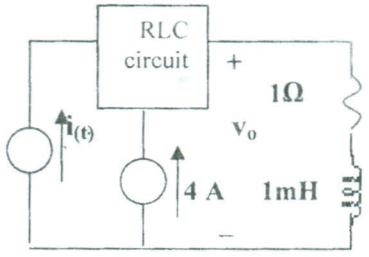

Fig. 1

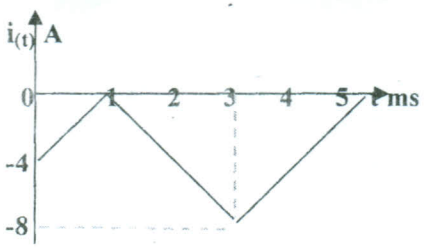

Fig. 2

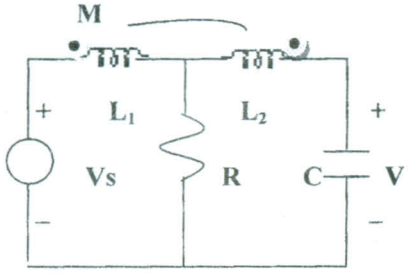

Fig.3

3- For the circuit in Fig.4 , find the power in the 4Ω resistance. (12 pts)

4- Find V_o and I_o For the circuit in Fig. 5 , assume ideal Op Amp. (10 pts)

5-For the circuit in Fig.6 , S_1 was connected to node a for a very long time. At t = 0 , S_1 switches from a to b . Find $i_{2(t)}$ and $v_{2(t)}$ (12 pts)

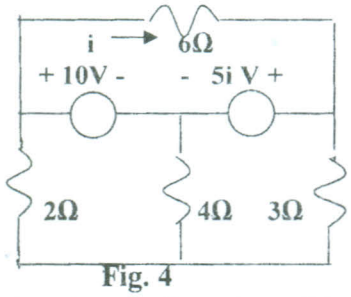

Fig. 4

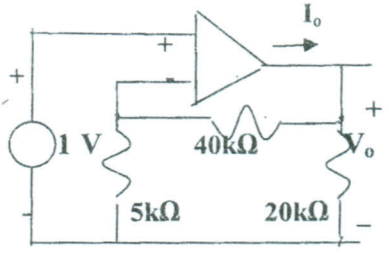

Fig. 5

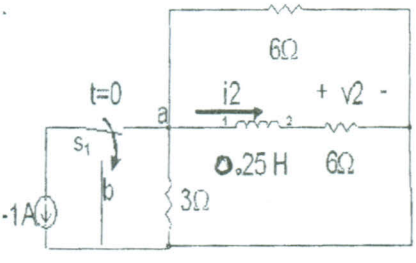

Fig.6

6-A resistance R and a coil having inductance L and resistance r , are connected in series across a 240 volt 50 Hz supply. A current of 3 A flows lagging by 37° behind the supply voltage. The magnitude of the voltage across the coil is 171 volts. Find R , the quality factor of the coil , the power lost in the circuit, and the reactive power. (12 pts)

7- Find a circuit having the given matrix equation. Find the transfer impedance Z_{31}

$$\begin{bmatrix} 50 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 3+j4 & -(1+j) & 0 \\ -(1+j) & 8-j6 & -1+j \\ 0 & -1+j & 4+j3 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix}$$

(15 pts)

8- For the circuit in Fig.7, if $v_s = 2 \sin 10^6 t$ V , Find the average power absorbed by the 3 Ω resistance. (10 pts)

7- Find the maximum power you can obtain from the circuit in Fig. 8 (12 pts)

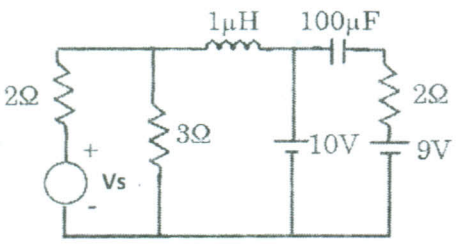

Fig. 7

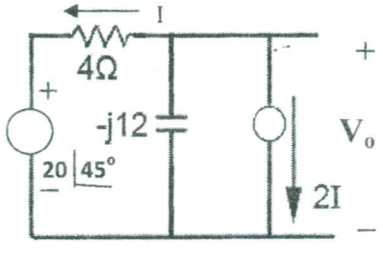

Fig. 8

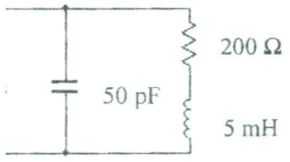

Fig. 9

8- Three equal impedances each $30\angle 30^\circ$ Ω are connected in star to a 3-ph 3-wire 208 v system, by conductors which have impedances $0.8 + j0.8$ Ω each . what is the line voltage at the load. What is the power supplied to the load and what is the power lost in the conductors? (12 pts)

10- A variable frequency current source with internal resistance 750 kΩ is connected to the resonance circuit shown in Fig. 8. Find the resonant frequency , the dynamic resistance, the quality factor of the circuit and the band width. (12 pts)