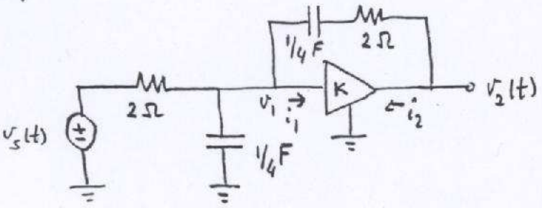
METU/EEED

EE 202/2PS II

Spring 2009

1)



$$\begin{bmatrix} i_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ K & 0 \end{bmatrix} \begin{bmatrix} v_1 \\ i_2 \end{bmatrix}$$

$K > 1$

$v_s(t) = V_m \cos(\omega t + \theta_s)$

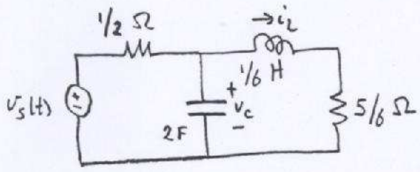
(a) Find the particular solution when $\omega = 3$ rad/sec.

(b) Find the homogeneous solution for (i) $K=2$, (ii) $K=3$, (iii) $K=4$, (iv) $K=5$, (v) $K=6$.

(c) For each K value above discuss whether the steady-state is well defined or not. In case the steady-state well defined, find the steady-state solution.

(d) Find the particular solution when $\omega = 2$ rad/sec and $K=2$. Discuss the existence of the steady-state solution.

2)



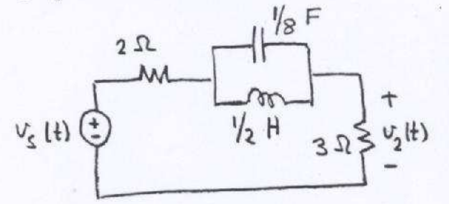
$v_s(t) = 2 + 4\cos(2t + 60°) + \sin(3t)$ V

The circuit is in the steady-state.

(a) Find $v_c(t)$ and $i_L(t)$.

(b) Compute the average powers delivered to the resistors, the average power supplied by the source, the average stored energies in the capacitor and in the inductor.

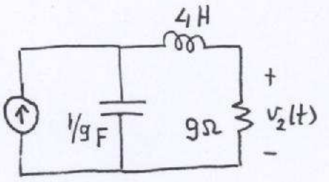
3)



$v_s(t) = 10 + 6\cos(t + 15°) + 12\cos(4t - 28°) + 3\cos(6t + 10°)$ V

The circuit is in the steady-state

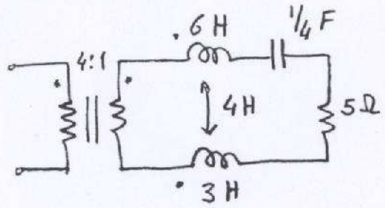
Find $v_2(t)$.

4) 

$v_2(t) = 18\cos(3t + 60°)$ V

(a) Find $i_s(t)$.

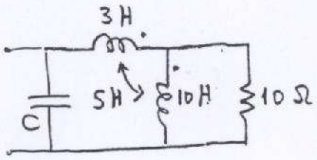
(b) Sketch the phasor diagram.

5) 

The one-port is in the SSS at the frequency ω rad/sec.

Find the input impedance $Z(j\omega)$.

For which values of ω is this one-port resistive? capacitive? inductive?

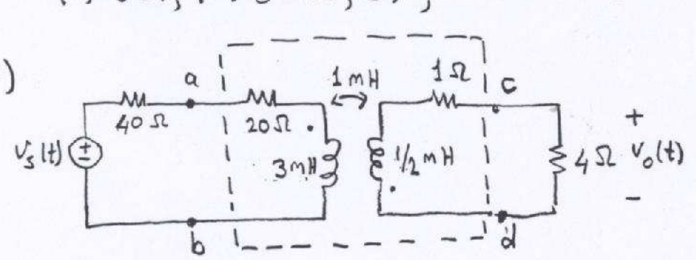
6) 

The one-port is in the SSS at the frequency 2 rad/sec.

(a) Find the input admittance $Y = G + jB$ in terms of C.

(b) Define $\gamma \triangleq G/|Y|$. Determine the value of C such that

(i) $\gamma = 1$, (ii) $\gamma = 0.8$, $B > 0$, (iii) $\gamma = 0.8$; $B < 0$.

7) 

$v_s(t) = 20\cos(4\times10^3 t)$ V

The circuit is in the SSS.

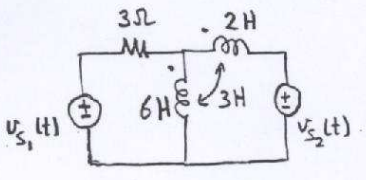
(a) Transform the circuit to the phasor domain.

(b) Obtain the chain parameters of the indicated two-port.

(c) Using the chain parameters find the Thevenin equivalent as seen to the left of the terminal pair c-d.

(d) Find $v_o(t)$.

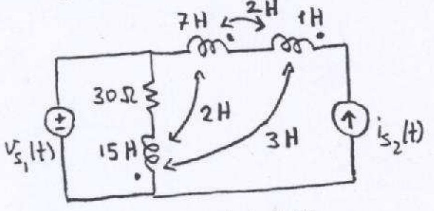
8) The circuit is in the steady-state. Compute the average power delivered to the resistor and the average stored energy in the coupled inductor.



$v_{s_1}(t) = 6\cos(2t)$ V

$v_{s_2}(t) = 10\sin(t+30°)$ V

(a)

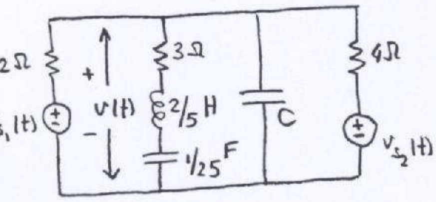


$v_{s_1}(t) = 30\sin(2t)$ V

$i_{s_2}(t) = \frac{\sqrt{13}}{6}\cos(3t-15°)$ A

(b)

9)



$v_{s_1}(t) = V_{M_1}\cos(5t+\theta_1)$ V

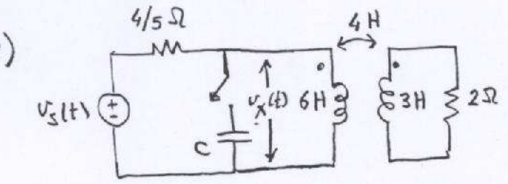
$v_{s_2}(t) = V_{M_2}\cos(12.5t+\theta_2)$ V

$v(t) = \sqrt{2}\,[60\cos(5t) + 90\cos(12.5t)]$ V

(a) Compute $P_{3\Omega_{avg}}$.

(b) The average power supplied by the left source is 2 KW. Compute $P_{2\Omega_{avg}}$

10)



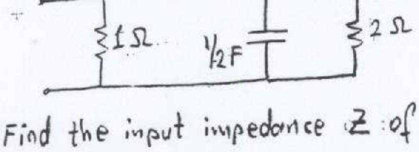
$v_s(t) = V_M\cos(2t+\theta_s)$ V

The circuit is in the SSS.

(a) The switch is open, $V_{x_{eff}} = 10$ V. Compute $P_{2\Omega_{avg}}$ and the average stored energy in the coupled inductor.

(b) The switch is closed, $V_{x_{eff}} = 10$ V. Determine the value of C so that the average power supplied by the source is 1 W less than that of Part (a).

11)



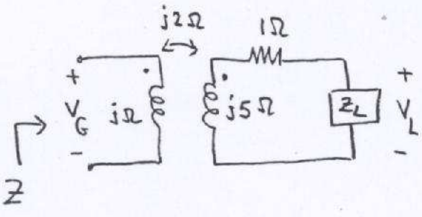
$i_s(t) = \sqrt{2}\cos(3t)$ A

The circuit is in the SSS.

(a) Find the input impedance Z of the one-port.

(b) Show that $Z\,I_{s_{eff}}^2 = [P_{1\Omega_{avg}} + P_{2\Omega_{avg}}] + j2\cdot 3\cdot [E_{L_{avg}} - E_{C_{avg}}]$.

12)

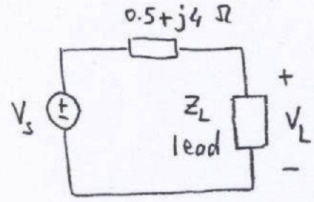


$|V_L| = \sqrt{2}\ 10$ V, $Z_L = 1 + j3\ \Omega$

(a) Find $|V_G|$ and Z.

(b) Compute the average power delivered to the resistor and the ratio of the average stored energies in the coupled inductor and in Z_L.

13)

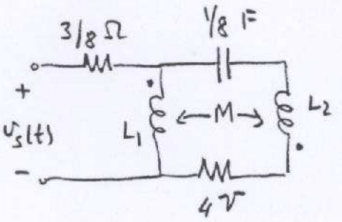


$V_L = 200$ Vrms

$P_{s_{avg}} = 3.4$ KW, $P_{L_{avg}} = 3.2$ KW

Find $V_{s_{eff}}$.

14)



$v_s(t) = V_m \cos(4t + \theta_s)$ V

The coupled inductor is passive.

The one-port is in the SSS.

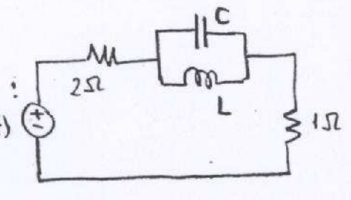
The average power delivered to the 3/8 Ω resistor is 6 W.

The average stored energy in the coupled inductor is 4 J.

The input impedance of the one-port is $Z = Z_m (0.6 - j0.8)\ \Omega$.

Find V_m and Z_m.

15)



$v_s(t) = \sqrt{2}\ 50 \cos(2t)$ V

The circuit is in the SSS.

$P_{2\Omega_{avg}} = 200$ W, $E_{c_{avg}} = 200$ J.

Find $E_{L_{avg}}$.