EE 202
Summer 2004

① A linear time invariant circuit is analyzed with four different methods. One of the analyses has an error in the sign of a coefficient.

a) TRUE / FALSE : The analysis is for zero state solution.

b) Match the given equation sets and the analysis types. Possibilities: {Node, Mesh, State, Scalar Dif.}.

c) Correct the +/- sign error. (Show your steps, Remember that all four analyses describe the same circuit. Explain your reasoning)

$$\dot{V}_1 = -2V_1 + 3V_2$$
$$\dot{V}_2 = V_1 - 4V_2$$
(I)

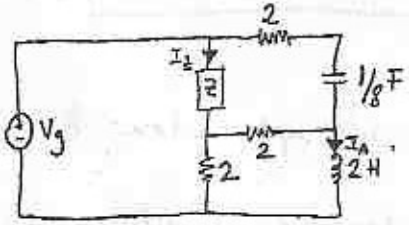
$$(3D^2 + 10D + 15)\, i_1 = 0$$
(II)

$$\dot{I}_2 + 2I_2 + I_3 = 0$$
$$\dot{I}_2 - 5I_2 + \dot{I}_3 + 5\dot{I}_3 = 0$$
(III)

$$\dot{e}_a + 5e_b - \tfrac{1}{4}\dot{e}_c = 0$$
$$-5e_a + 2\dot{e}_b + \dot{e}_c = 0$$
$$6e_a + e_c = 0$$
(IV)

② For the circuit below, the following information is given:

$$V_g = 30\cos(2t)$$

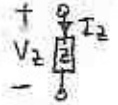


a) If $I_A = 10\cos(2t)$, what is the circuit element denoted by Z?

b) If $I_2 = \cos(2t)$, what is the circuit element denoted by Z?

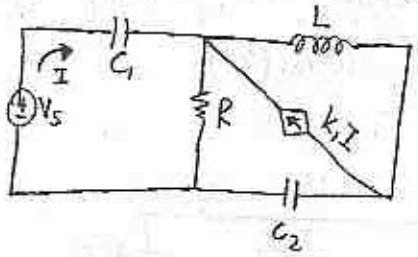
c) Assume that, the circuit element in the box has the following terminal relation:

$$V_Z = K \cdot \frac{d^2 I_Z(t)}{dt^2}$$



What is the phasor domain equivalent of this element?

(3) a) Find the State Eqn's for the given circuit.



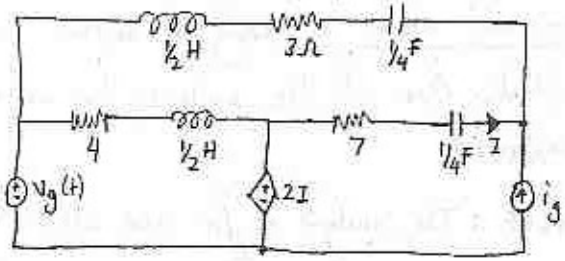
b) Determine the state eqn. when $k=-1$.

c) Show that when $k=-1$, there exists a mode with zero eigenvalue. Show that the mode with zero eigenvalue preserves its initial condition. That is, $V_{C_1}(t) = V_{C_1}(0)$ for $t \geq 0$

d) Find the initial condition to excite the mode with zero eigenvalue.

(3)

(4)



$V_g(t) = 4\sin 4t$

$i_g(t) = 5\cos(4t+30)$

a) Find current I, and average power absorbed by 7Ω resistor when V_g is on, I_g is off. (I_g is disconnected).

b) Find current I, and average power absorbed by 7Ω resistor when I_g is on, V_g is off.

c) Find the current I, the consumed power by 7Ω resistor when both sources are on.

d) Do you expect total power calculated in part c to be sum of the calculated powers in parts a and b? Explain your reasoning.

(4)