EE2008 Circuits (Part I) Homework Assignment 1

Q.1 In the circuit of Fig. 1, the switch has been in the position shown for a long time and is thrown to the other position for time $t \geq 0$. Determine the values of the voltages and currents in the inductor and capacitor just before and just after the switch has been moved to the final position.

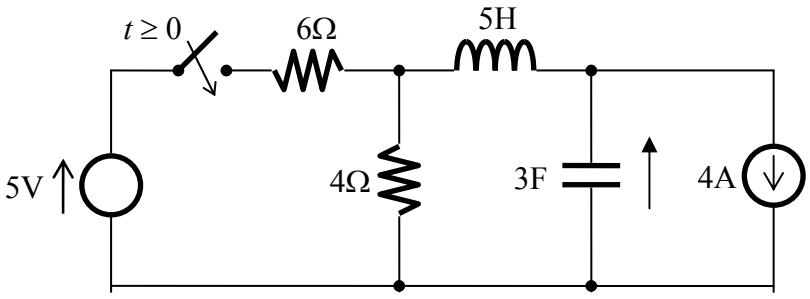

Fig. 1

Q.2 Assuming the capacitor to be initially uncharged, derive the differential equation from which the inductor current can be found in the circuit of Fig. 2. For what range of values of C will the circuit be underdamped? If C is such that the circuit is critically damped, will a change in the source voltage make it underdamped?

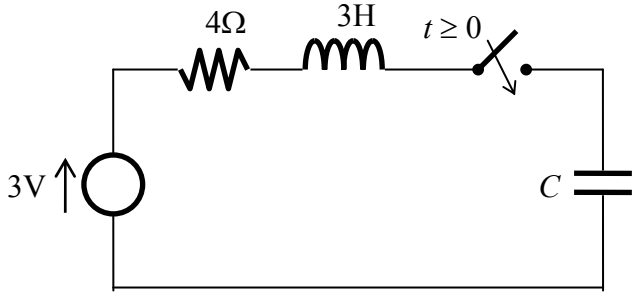

Fig. 2

Q.3 Assuming the capacitor to be initially uncharged, derive the differential equation from which the inductor current can be found in the circuit of Fig. 3. Determine the values of C for the circuit to be critically damped.

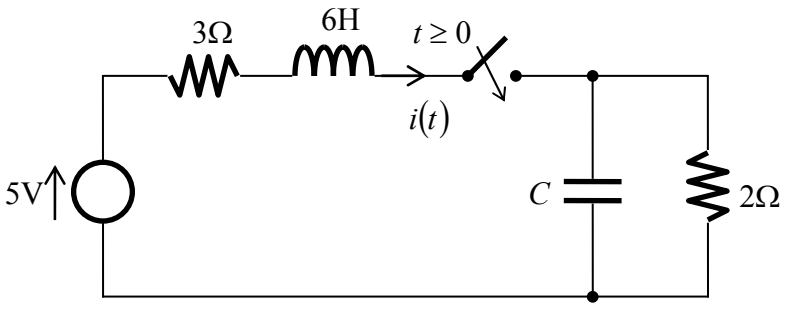

Fig. 3

Q.4. In the circuit of Fig. 4, the switches have been in the positions shown for a long time and are thrown to the other position for $t \geq 0$.

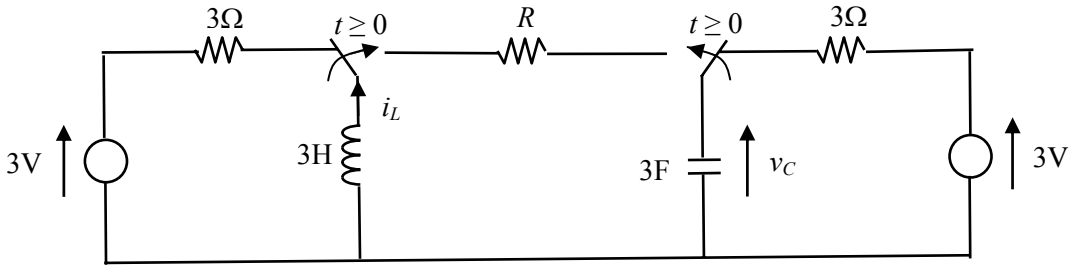

Fig. 4

(a) Determine the capacitor voltage and inductor current for $t < 0$.

(b) Derive the governing differential equation in term of the capacitor voltage for $t \geq 0$.

(c) Determine the value of R such that the circuit has a critically damped response.

(d) For the value of R obtained in Part (c), determine the complete response of the inductor current for all time t.

Q.5 In the circuit of Fig. 5, the switch has been in the position shown for a long time and is thrown to the other position for time $t \geq 0$. Determine the inductor current and voltage as well as the capacitor current and voltage just before and just after the switch has been moved to the final position. Determine the steady state current of the voltage source and the steady state voltage of the current source.

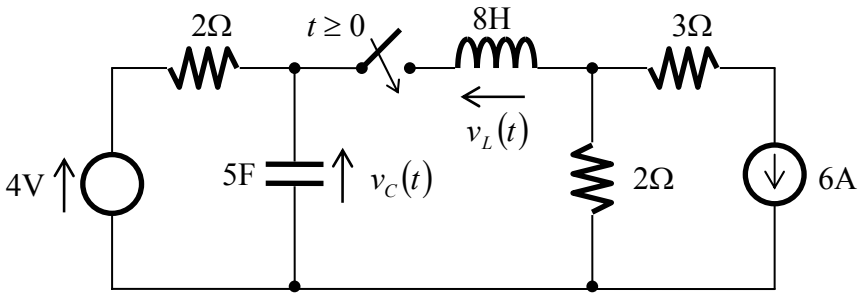

Fig. 5

EE2008 Circuits (Part I) Homework Assignment 2

Q.1 Consider the circuits given in Fig. 1 below. Assume that both the capacitor and the inductor are initially discharged, and the unit of resistors is in Ω, capacitor in F and inductor in H and voltage source in volt.

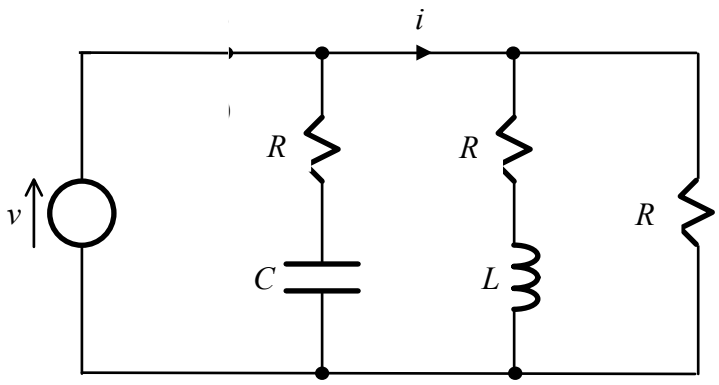

Fig. 1

(a) Derive the associated state and output equations with the input being the voltage source v and the output being the current i.

(b) Compute the transfer function of the circuit. What are the poles of the system? Is it stable? Why?

(c) Compute the zero response and complete response of the circuit if v = 1 volt.

Q.2 Consider the circuits given in Fig. 2 below. Assume that both the capacitor and the inductor are initially discharged.

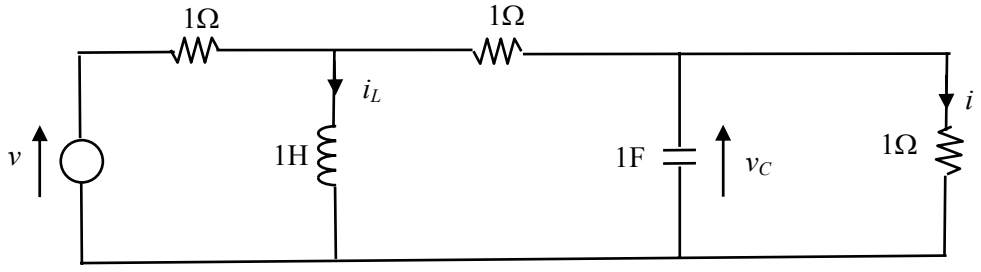

Fig. 2

(a) Derive the associated state and output equations with the input being the voltage source v and the output being the current i.

(b) Compute the transfer function of the circuit. What are the poles of the system? Is it stable? Why?

(c) Let v = 1 V. Compute the zero input response and complete response of the circuit.

(d) Sketch the complete response obtained in Part (c).

Q.3 Consider the circuit given in Fig. 3 below. Assume that the capacitor is initially charged to 1V and the inductor is initially uncharged.

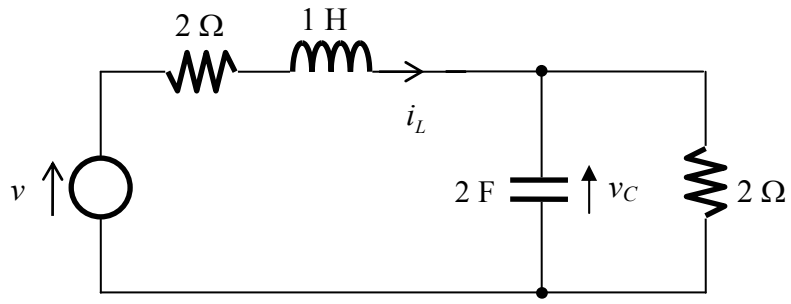

Fig. 3

(a) Derive the associated state and output equations with the input being the voltage source, v, and the output being the current, i_L.

(b) Compute the transfer function of the circuit. What are the poles of the system? Is it stable? Why?

(c) Compute the zero response and the complete response of the circuit if v = 5V.

(d) Sketch the complete response obtained in Part (c) for up to 5 seconds.