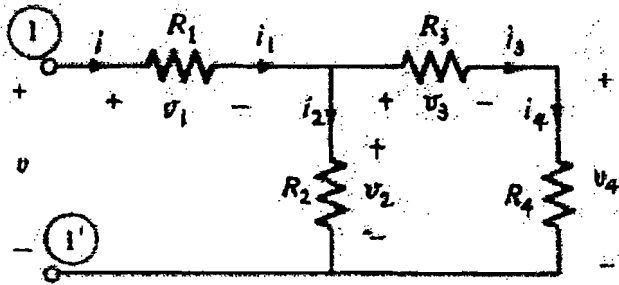


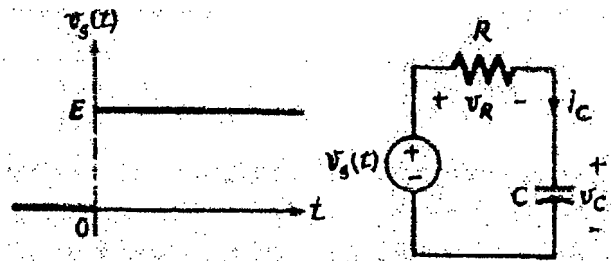
1. Give a ladder circuit shown on the following figure.

The input terminal is a voltage v and output terminal is voltage v_4 . There are total 4 resistors R_1 , R_2 , R_3 , and R_4 . Please answer the following questions: [20 credits]

- a. The relationship between v_2 and i_3 with respect to resistors R_3 and R_4 . [5]
- b. The relationship between i_1 and v_2 with respect to resistor R_2 , R_3 and R_4 . [5]
- c. The relationship between v and i_1 with respect to resistor R_2 , R_3 and R_4 . [5]
- d. The equivalent resistor R of all resistors. [5]



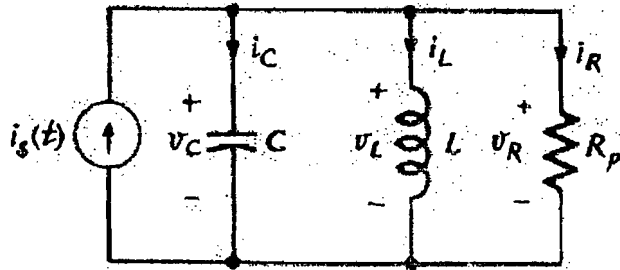
2. Give a RC circuit, shown as follow. Please use the general conditions of capacitor: $v_c(t_0)=0$, $t_0=0$, and $v_{oc}(t) = E$, $t \geq 0$, where the v_{oc} is Thevenin equivalent voltage source $v_{oc}(t)$. Please give the voltage of $v_c(t)$ corresponding to the given circuit and general conditions of capacitor. [20 credits]



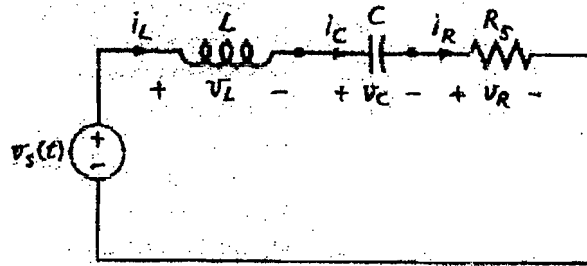
3. Please explain the meaning and conditions of the following terminologies. [12 credits]

- a. Overdamped response of a zero-input response. [4]
- b. Underdamped response of a zero-input response. [4]
- c. Critically damped response of a zero input response. [4]

4. Give the following two linear time-invariant circuits, shown as follows. Please write down their standard forms of second-order differential equations. [20]



(a)



(b)

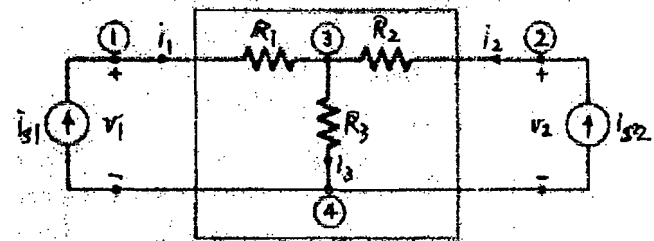
5. Give the following circuit, shown as follow. Please answer the following questions:

$$i_1 = (A) v_1 - (B) v_2$$

$$i_2 = (C) v_1 + (D) v_2$$

Write down the answer of (A), (B), (C), and (D)

with respect to resistors R_1 , R_2 , and R_3 . [20 credits]



6. Give an ideal transformer, shown as follow. Please give the definition of the following: [8 credits]

A relationship is given as

$$v_1/i_1 = (A) (v_2/i_2) = (B)R.$$

Please write down the answers of (A) and (B).

