NETWORK THEORY

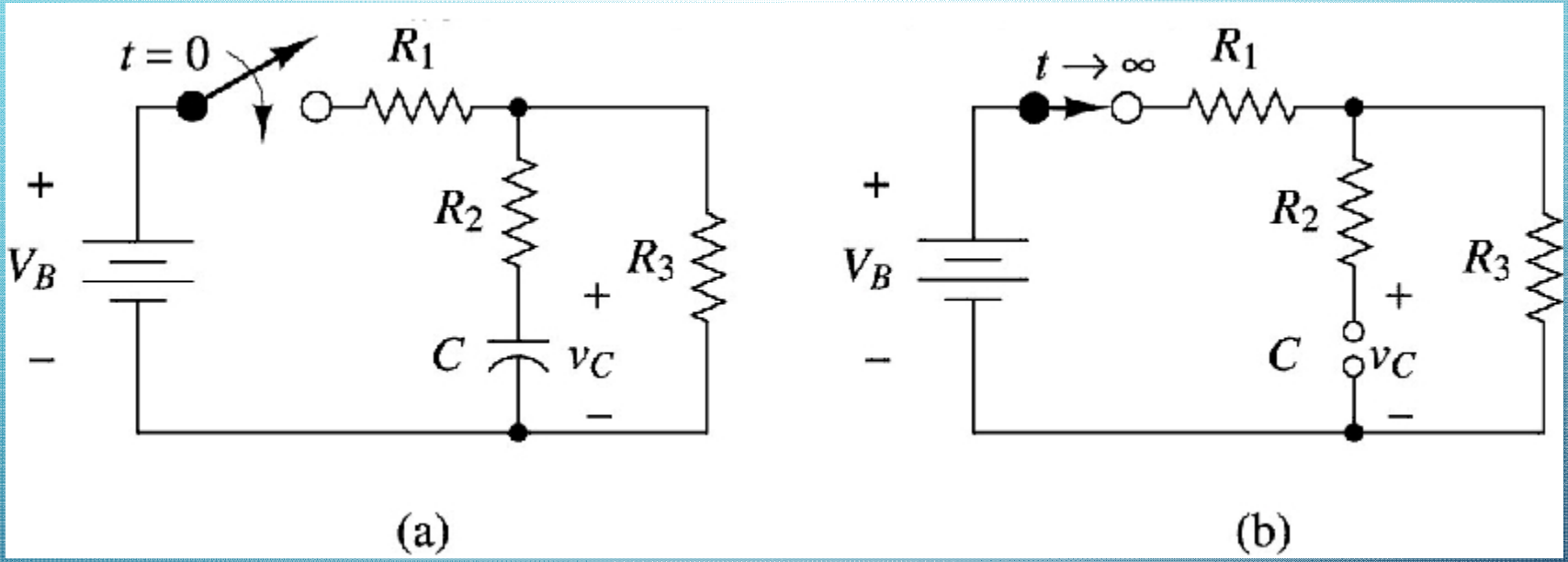
LECTURE 2

SECTION A

TOPIC COVERED :TRANSIENT RESPONSE OF RC, RL

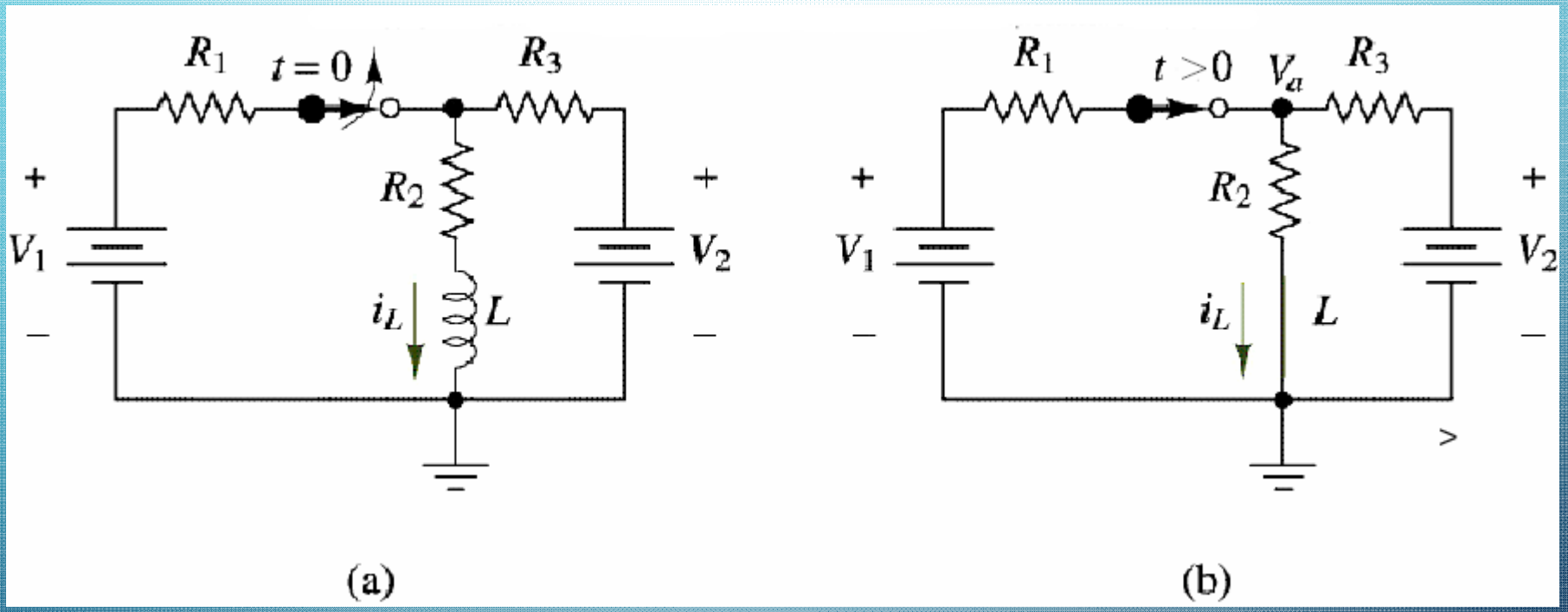
(a) Circuit at t = 0
(b) Same circuit a long time after the switch is closed

Figure 5.9,



The capacitor acts as open circuit for the steady state condition (a long time after the switch is closed).

(a) Circuit for t = 0
(b) Same circuit a long time before the switch is opened



The inductor acts as short circuit for the steady state condition (a long time after the switch is closed).

WHY THERE IS A TRANSIENT RESPONSE?

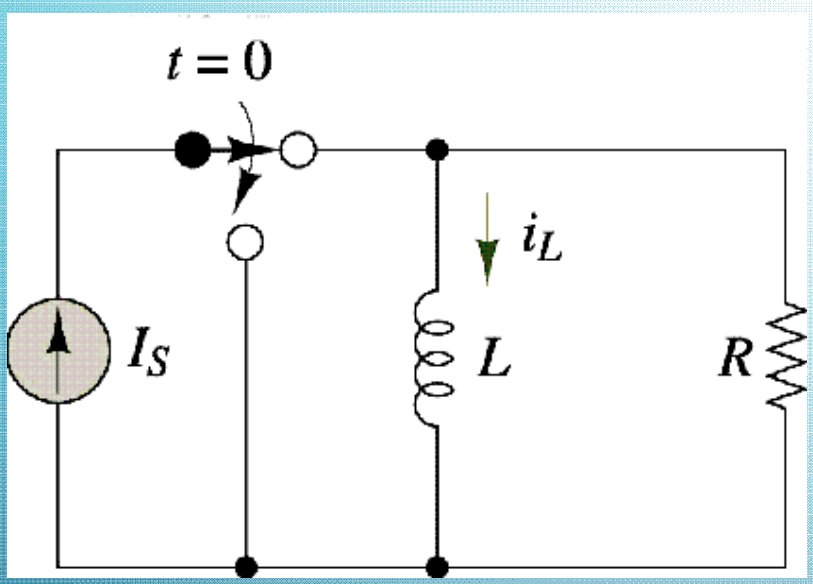
- The voltage across a capacitor cannot be changed instantaneously.

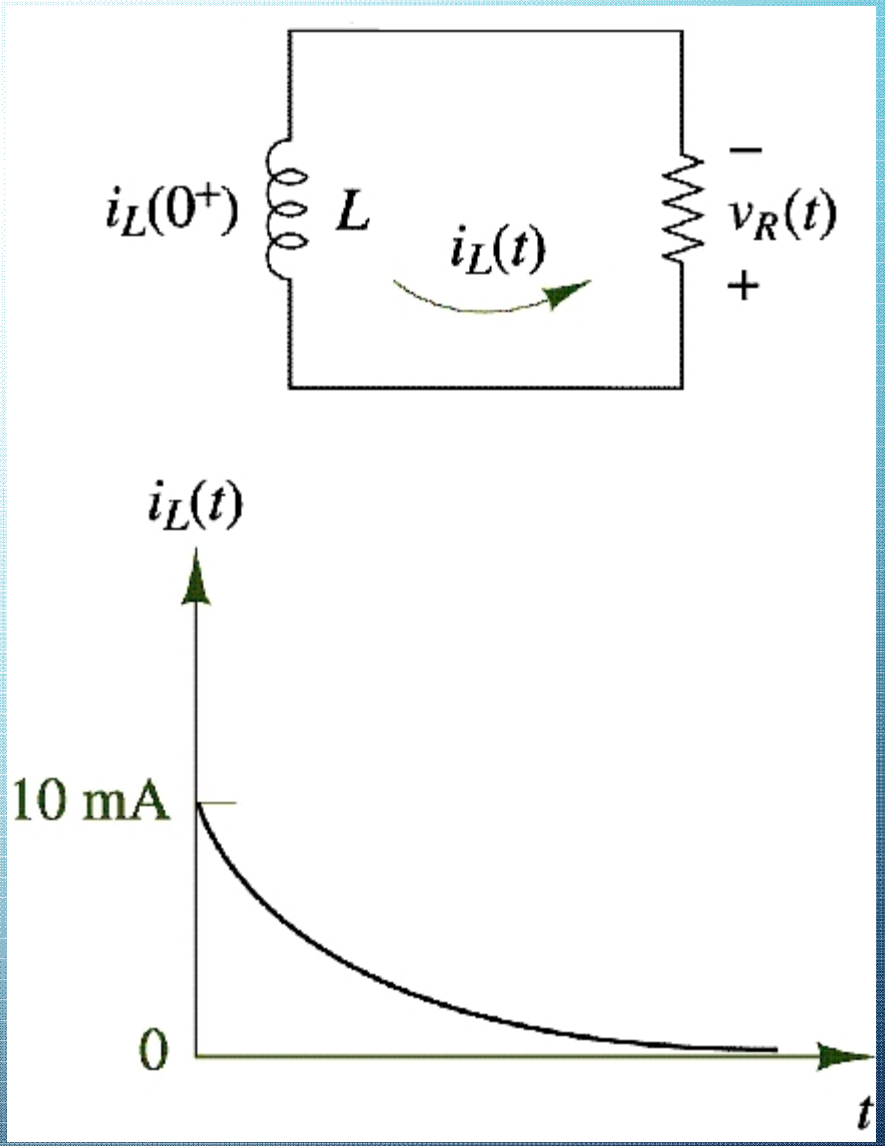
$$V_C(0^-) = V_C(0^+)$$

- The current across an inductor cannot be changed instantaneously.

$$I_L(0^-) = I_L(0^+)$$

Example





TRANSIENTS ANALYSIS

1. Solve first-order *RC* or *RL* circuits.

2. Understand the concepts of transient response and steady-state response.

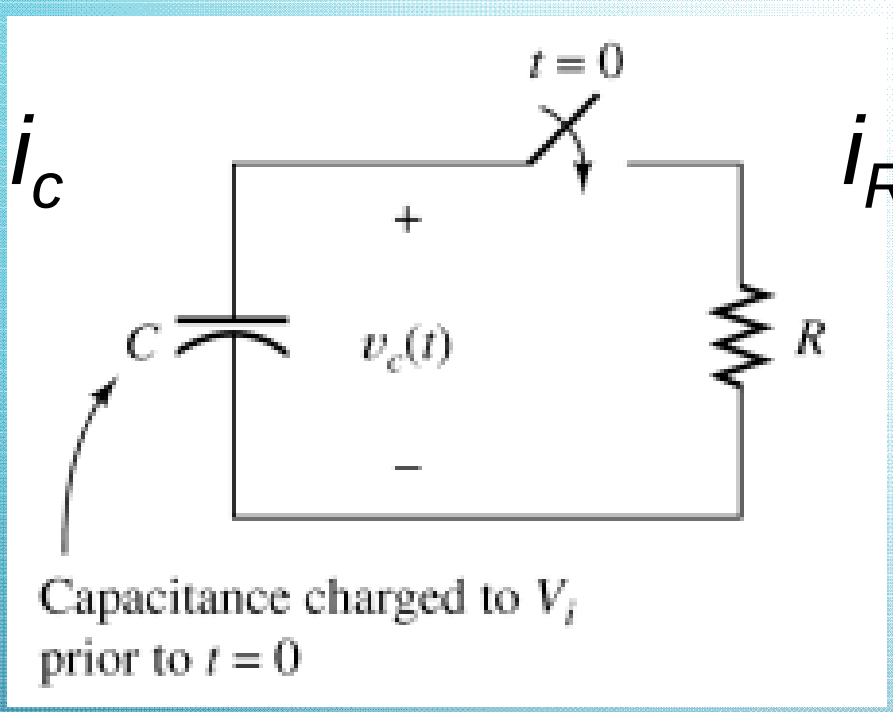
3. Relate the transient response of first-order circuits to the time constant.

TRANSIENTS

The solution of the differential equation represents are response of the circuit. It is called *natural response.*

The response must eventually die out, and therefore referred to as *transient response.* (source free response)

DISCHARGE OF A CAPACITANCE THROUGH A RESISTANCE



Capacitance charged to V_i prior to $t = 0$

$$\sum i = 0, \quad i_C + i_R = 0$$

$$C\frac{dv_C(t)}{dt} + \frac{v_C(t)}{R} = 0$$

Solving the above equation with the initial condition $V_c(0) = V_i$