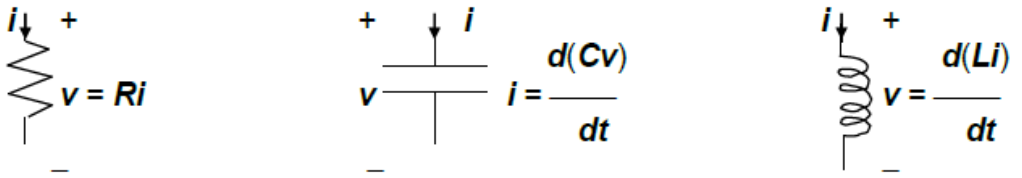
ECE101: Basic Electrical and Electronic Circuits

To be discussed during Feb 10-14



Linear Resistor | Linear Capacitor | Linear Inductor

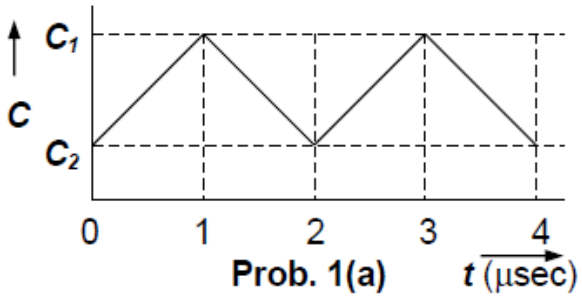
For linear time-invariant capacitors and inductors, $i = C(dv/dt)$ and $v = L(di/dt)$ respectively.

Q.1.

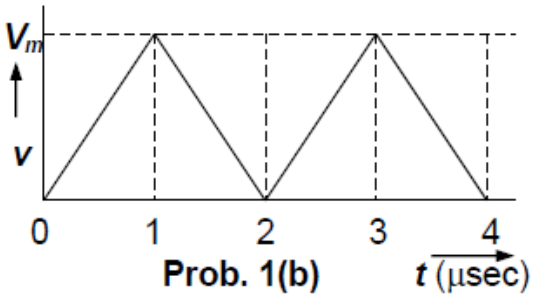
Sketch the waveform of the current flowing through a linear capacitor for $0 < t < 4\mu$sec if

(a) a constant voltage v = 10 volts is applied to the capacitor and the capacitance C varies with time as shown below, where C_1 = 2000pF and C_2 = 1000pF.

(b) the capacitor has a constant capacitance C = 1000pF and the applied voltage v varies with time as shown below, where V_m = 10 volts.



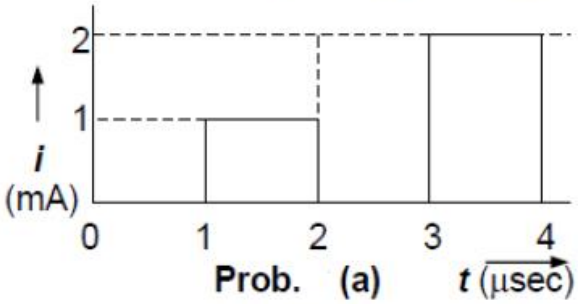
Prob. 1(a)



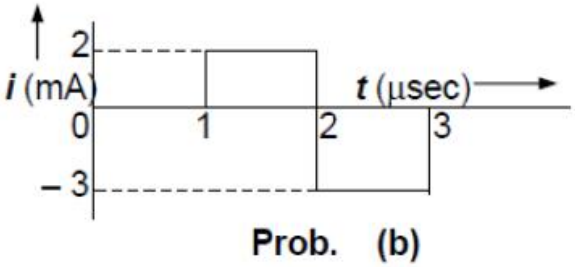
Prob. 1(b)

Q.2.

Calculate and sketch the waveform of the voltage v across a linear capacitor having a constant capacitance C = 0.01μF if the capacitor is initially uncharged and the waveform of the current i flowing through the capacitor for a period of 4μsec is as given below.



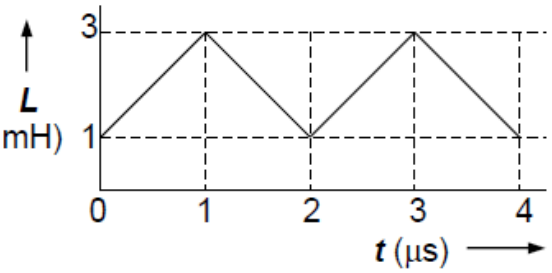
Prob. (a)

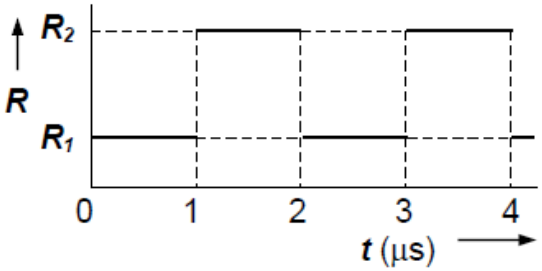


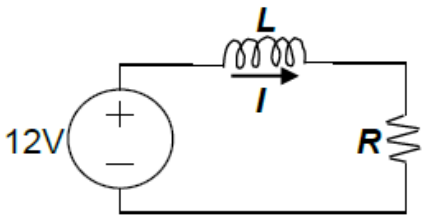
Prob. (b)

Q.3.

A linear time-varying inductor having inductance ***L*** and a linear time-varying resistor having resistance ***R*** are connected in series with a 12V d-c voltage source. Variations in ***L*** and ***R*** with time are as shown in the graphs given below, and the resulting current through the series combination is ***I*** = 3mA (d-c). Find the values of R_1 and R_2.





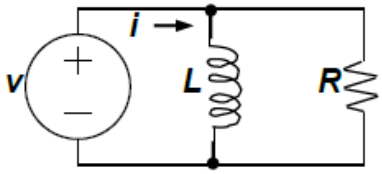


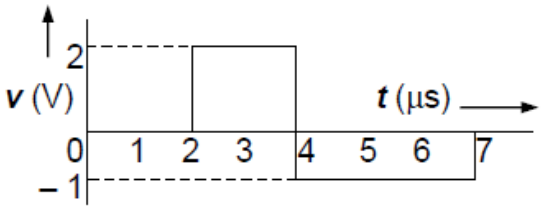
(a) Write KVL equations for the two time intervals $0 < t < 1$ (μs) and $1 < t < 2$ (μs) in terms of R_1 and R_2.

(b) Hence determine the values of R_1 and R_2.

Q.4.

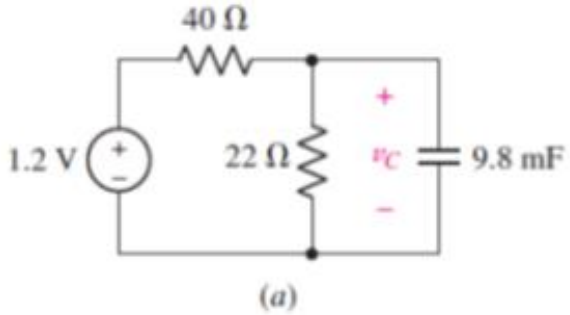
A voltage ***v*** having the waveform given below is applied to the parallel combination of a linear time-invariant inductor having inductance ***L*** = 2mH and a linear time-varying resistor having resistance ***R*** = 2kΩ for $0\mu s < t \leq 4\mu s$ and ***R*** = 1kΩ for $4\mu s < t \leq 7\mu s$. Calculate the current ***i*** in the given circuit at instants of time ***t*** = 3μs and 6μs if the inductor current at time ***t*** = 0 is zero.

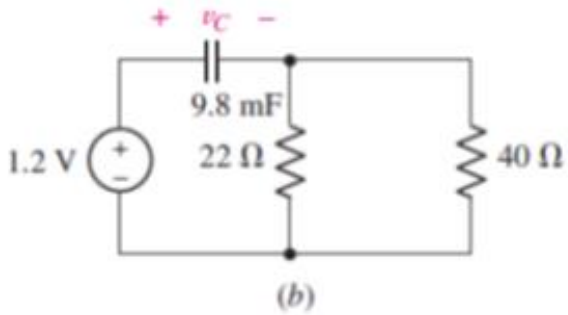




Q.5.

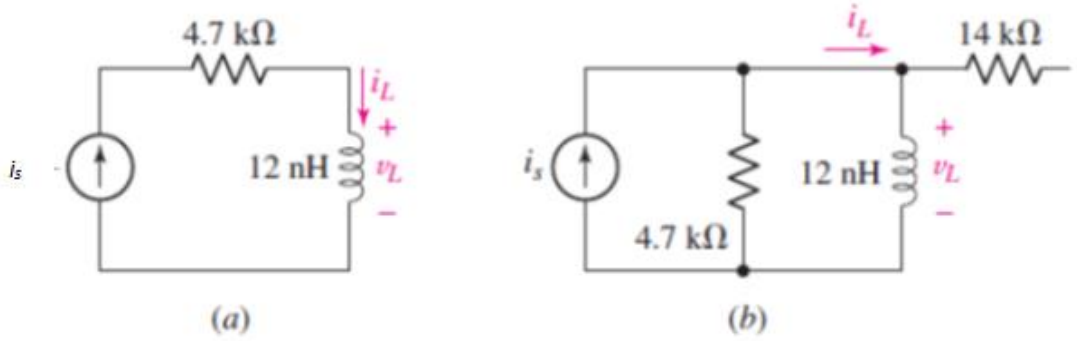
Calculate the power dissipated in the 40Ω resistor and the voltage labelled v_C in each of the circuits depicted in **Fig. (a) and (b)**.





Q.6.

Calculate v_L and i_L for each of the circuits depicted in **Fig.** if $i_s = 1$ mA



Q.7. Find current i and voltage v in the given circuit: