ECE 232
Lab1
First order circuits

Preliminary Work:
1. Consider the circuit and the input voltage waveform $V_{in}(t)$ (which is a square wave with some DC value) on Figure. Take V_1=1V and V_2=3V.

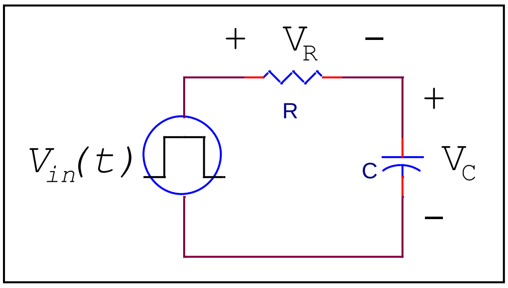

Figure 1: The circuit

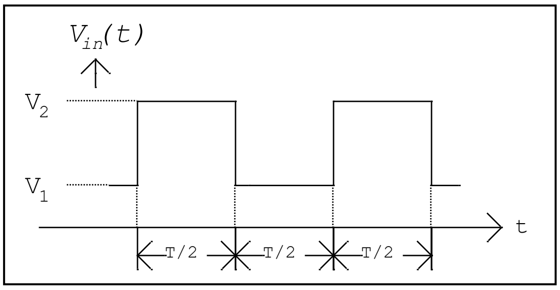

Figure 2: The input waveform $V_{in}(t)$

a. Obtain the differential equation for the circuit. For the values of f, R and C in Table 1, determine and sketch $V_C(t)$ and $V_R(t)$. Calculate the time constant τ for each case.

	f (kHz)	R (kΩ)	C (nF)
1	2	3.3	4.7
2	2	3.3	10
3	2	68	10

Table1

b. Replace the capacitor in Figure with an indictor L. Obtain the differantial equation and for the values of f, R, and L in Table 1, determine and sketch $V_L(t)$ and $V_R(t)$ for the input in part 1. Calculate τ in each case.

f (kHz)	R (kΩ)	L (H)
2	3.3	0.1
2	1.8	0.1
10	3.3	0.1

Table2

c. How can τ be found experimentally from the voltage waveforms seen on oscilloscope screen? *Hint:* Consider the exponential characteristics of voltage waveforms in one interval.

Experimental Work

1. Adjust the square wave output of the function generator as in Preliminary Work part 1.
a. Set up the circuit on the Figure 1. For the values of f, R and C in the Table 1, observe and plot the AC components of $V_{in}(t)$, $V_C(t)$ and $V_R(t)$, also note the DC levels in each case. Determine the time constant τ of the circuits experimentally.
b. Replace the capacitor C with the inductor L and repeat part 1.a for the values of f, R and C in the Table 2.

Equipment List: Resistors: 1.8kΩ, 3.3kΩ, 68kΩ, Capacitors: 4.7nF, 10nF, Inductors: 100mH