

Physics 334, Winter Quarter 2013

Electric Circuits Laboratory I

Homework Assignment 3

Due Tuesday January 29

1. A RC low-pass filter contains a $1\ \mu\text{F}$ capacitor and a 1k resistor. The input is at 0 Volts for a long time. Now suppose a single “square” voltage pulse of 5 V for 1 ms duration is applied to the input. Carefully and neatly sketch the resulting output, including numeric values, of output voltage versus time.
2. The resistor and capacitor in problem 1 above are interchanged and the same square pulse is applied. Carefully and neatly sketch the resulting output, including numeric values, of output voltage versus time.
3. A two-terminal “black box” is known to contain an inductor L , a capacitor C , and a resistor R . On connecting a 1.5 V battery, 1.5 mA flows. When an AC voltage of 1V RMS at 60 Hz is connected, 10 mA RMS flows. As the frequency increases at a fixed 1 V RMS, the current reaches a maximum of over 100 A at 1 kHz. (a) Carefully and neatly sketch the circuit in the black box and (b) find values for L , C and R .
4. (a) A purely real load impedance $1000\ \Omega$ is connected across an AC voltage source of amplitude 10 V and frequency 60 Hz. What’s the average power dissipated within the load? (b) A purely imaginary load impedance $1000\ i\ \Omega$ is connected across the same AC voltage source. What’s the average power dissipated within the load? (c) A complex load impedance $1000(1 + i)\ \Omega$ is connected across the same AC voltage source. What’s the average power dissipated within the load?