

Department of Mechanical Engineering
2.010 CONTROL SYSTEMS PRINCIPLES

Laboratory Preparation Exercise 1

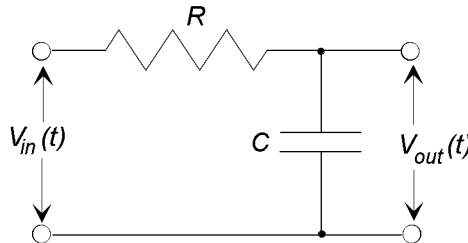
Laboratory Objectives:

- (i) Familiarization with the laboratory hardware components.
- (ii) Familiarization with the “Virtual Bench” computer based laboratory instruments (oscilloscope, function generator, digital voltmeter, digital signal analyzer).
- (iii) The use of the Virtual Bench to make dynamic response measurements on a simple RC electrical circuit.

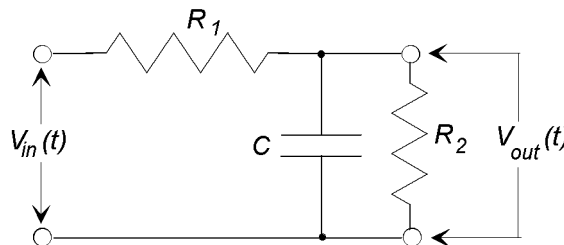
Preparation:

Before you come to the laboratory do the following exercise and be prepared to hand it in as part of the report. This should be simple review for you - refer to the 2.003 text.

- (a) Derive a differential equation relating the output voltage to the input voltage for the following circuit:



- (b) Derive the transfer function for the system.
- (c) Make a carefully annotated sketch of the step response, showing any characteristic time scales in terms of R_1 and C .
- (d) Repeat (a), (b), and (c) assuming the circuit is connected to an instrument with an input resistance R_2 as shown below. Comment on the effects of connecting the instrument to the circuit.



Note:

You may use any modeling method you choose. You may also use computer packages such as Matlab to assist you.