

## 24-352 DYNAMIC SYSTEMS & CONTROL

### HOMEWORK ASSIGNMENT #10

DUE 4/4/01

#### PROBLEMS

From the textbook

10.20 and 10.21

1. Suppose you have the circuit shown below.
  - a. What is its impedance?
  - b. What is the transfer function, i.e. the ratio  $E_o(s)/E_i(s)$ ?
  - c. Suppose  $L = 1$  and  $C = 1$ . Suppose  $e_i(t) = H(t)$  where  $H$  is the Heaviside step function.
    - i. What does the output voltage look like as a function of time if  $R = 1$ ?
    - ii. What value of resistance would result in an overshoot of 10%?  
Plot the response as a function of time for this value of  $R$ . What is the response time  $t_r$ , i.e. the time at which  $e_o(t)$  first equals 90% of its steady state value?
    - iii. Repeat part ii for an overshoot of 2%. (The response time is the time at which it equals 98% of its steady-state value).
    - iv. How much slower is the system's response, i.e. what is the percentage increase in the response time when the overshoot is reduced from 10% to 2%?
    - v. How does your answer to iv depend on the values of  $L$  or  $C$ ?

