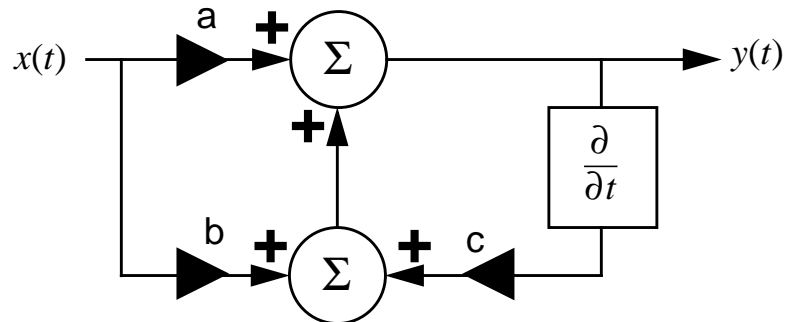


Name:

Problem	Points	Score
1a	10	
1b	10	
1c	10	
1d	10	
2a	10	
2b	10	
2c	10	
2d	10	
3a	10	
3b	10	
Total	100	

Notes:

1. The exam is closed books/closed notes - except for one page of notes.
2. Please show ALL work. Incorrect answers with no supporting explanations or work will be given no partial credit.
3. Please indicate clearly your answer to the problem. If I can't read it (and I am the judge of legibility), it is wrong. If I can't follow your solution (and I get lost easily), it is wrong. All things being equal, neat and legible work will get the higher grade:)

Problem No. 1: Block Diagrams

(a) Write a differential equation describing this system.

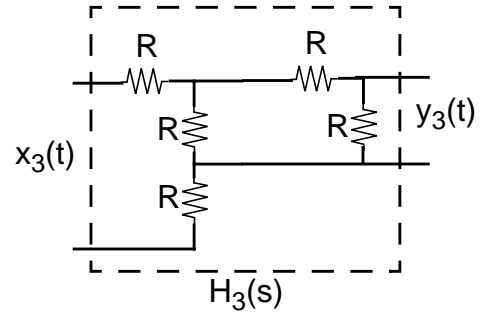
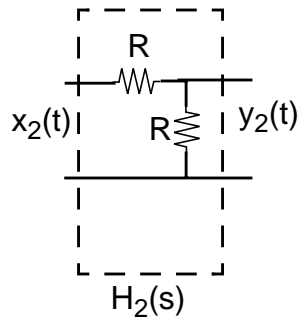
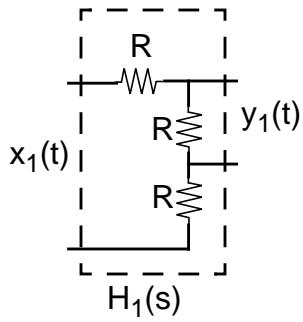
(b) Find the transfer function.

(c) For what values of a , b , and c is the system stable (consider only non-zero values of a , b , and c).

(d) Find the impulse response.

Problem No. 2: Transfer Functions

For the circuit shown below:

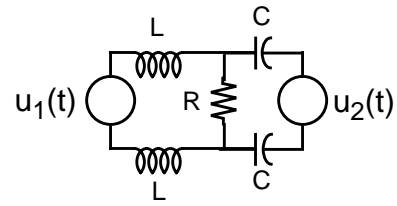


(a) Find $H_1(s)$:

(b) Find $H_2(s)$:

(c) Find $H_3(s)$:

(d) Is $H_3(s) = H_1(s) \bullet H_2(s)$? Justify your answer. Use as many concepts developed in this course as possible. A yes/no answer with no explanation gets no credit.

Problem No. 3: The “Interesting” Problem

- (a) Assume the voltage across the resistor in the circuit above is the output voltage, $y(t)$. Derive the state variables representation of this circuit.

(b) Now that you have finished (a), tell me how many state variables you should have used, and identify which voltages and/or currents they correspond to :)