ECE 2260 Midterm 2

Week of: March 23, 2019

Student's name: _____

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You have 12 hours for 5 problems. Taking additional time beyond the allotted time will result in point deductions.

- Show enough (neat) work in the clear spaces on this exam to convince us that you derived, not guessed, your answers.
- Put your final answers in the boxes at the bottom of the page.

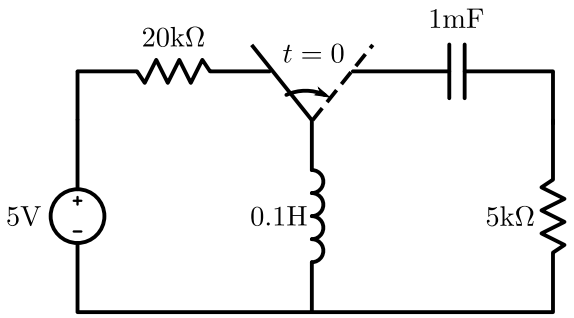
This test is take-home due to worldwide health concerns. As such, this is open book, open notes, and open computer. HOWEVER, you cannot collaborate with anybody else on this exam.

Problem	Score	Possible Points
1		20
2		20
3		20
4		20
5		20
Total score		100

1 Short answer

(a) What is the verb form of the word "convolution?"

(b) Redraw the following circuit in the s-domain.



(c) Given $F(s) = \frac{5s+2}{s(s+1)}$, find $f(t \to \infty)$. (*Hint:* the final value theorem might be helpful here.)

$f(t \to \infty) =$

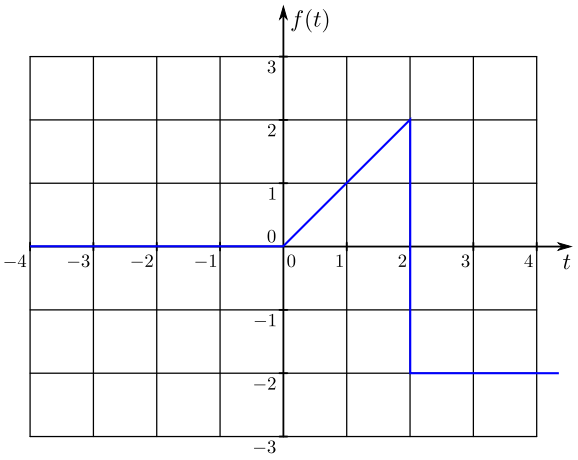
(d) if $f(t) = 3\cos(t)u(t)$ and $h(t) = \delta(t) - \delta(t-1)$, what is $f(t) * h(t)$?

$f(t) * h(t) =$

2 Laplace Transforms

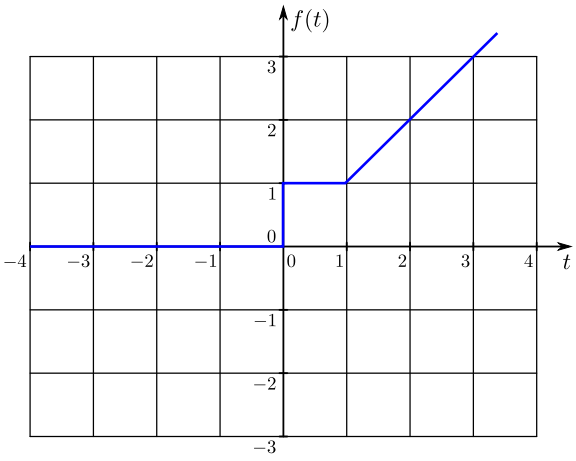
Find the Laplace transforms for the following functions. You may use direct integration or tables.

(a) Find $F(s)$.



$F(s) =$

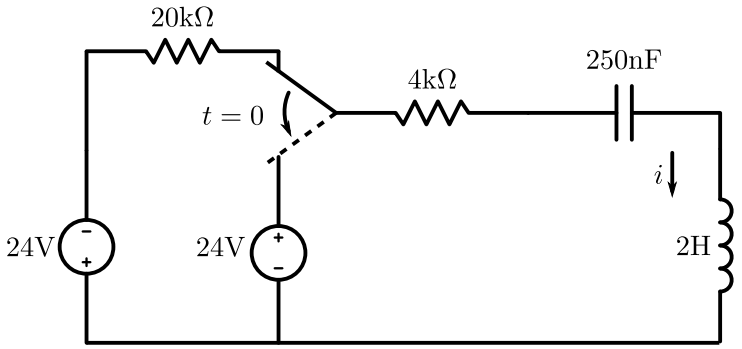
(b) Find $F(s)$.



$F(s) =$

3 Circuits in s-domain

For the following circuit, please do the following.



(a) Redraw the circuit in the s-domain.

(b) Solve for $I(s)$ in the s-domain.

Your work, continued...

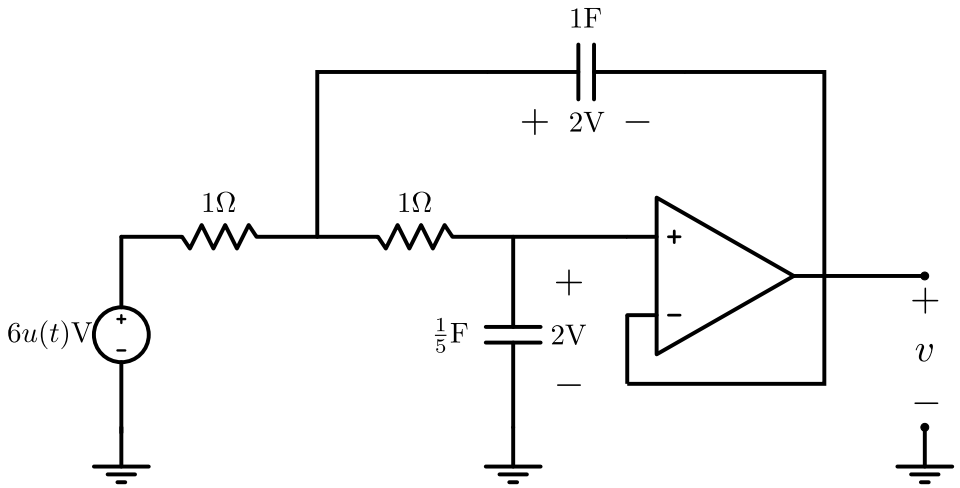
$I(s) =$

(c) Solve for $i(t)$ in the time domain.

$i(t)$

4 Op-amp circuits in the s-domain

For the following circuit, please do the following. (*Note:* the voltages over the capacitors are the initial voltages that were there magically before the step function voltage source turned on.)



(a) Redraw the circuit in the s-domain.

(b) Solve for $V(s)$ in the s-domain.

Your work, continued...

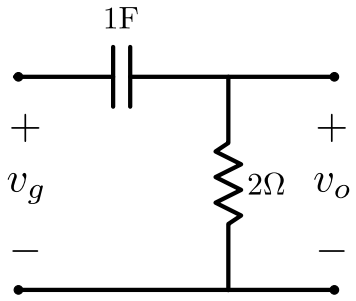
$V(s) =$

(c) Solve for $v(t)$ in the time domain.

$v(t)$

5 Transfer functions, impulse response functions, and convolution

For the following circuit, do the following



(a) Find the transfer function $H(s)$ (*Hint:* there are no initial conditions)

$H(s) =$

(b) Given an input $v_g(t) = u(t) - u(t-1)$ V and using the Laplace transform method, find $v_o(t)$. (*Hint:* remember that $V_o(s) = H(s)V_g(s)$)

$v_o(t) =$

(c) Find the impulse response function $h(t)$

$h(t) =$

(d) Given an input $v_g(t) = u(t) - u(t-1)\,\text{V}$ and using convolution, find $v_o(t)$ (*Hints:* remember that $v_o(t) = h(t) * v_g(t)$ and the answer here should match the answer you got earlier using the Laplace transform method)

$v_o(t) =$