

ID Number (last four digits) _____

Unified Quiz S6

April 27, 2005

One 8 $\frac{1}{2}$ " x 11" sheet (two sides) of notes

No calculators allowed.

No books allowed.

- Put your name on each page of the exam.
- Read all questions carefully.
- Do all work for each problem on the two pages provided.
- Show intermediate results.
- Explain your work --- don't just write equations. Any problem without an explanation can receive no better than a "B" grade.
- Partial credit will be given, but only when the intermediate results and explanations are clear.
- Please be neat. It will be easier to identify correct or partially correct responses when the response is neat.
- Show appropriate units with your final answers.
- Box your final answers.

Exam Scoring

#1 (15%)	
#2 (10%)	
#3 (25%)	
#4 (25%)	
#5 (25%)	
Total	

Problem 1 (15%)

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A causal, LTI system, G , has impulse response $g(t)$. The Laplace transform of $g(t)$ is

$$G(s) = \frac{4}{s(s+2)^2}$$

1. What is the region of convergence of the Laplace transform? Explain.
2. Find $g(t)$.
3. Is the system BIBO stable or unstable?

Problem 1

ID number (last four digits)_____

Problem 2 (10%)

ID number (last four digits) _____

A causal, LTI system, G , has impulse response $g(t)$ given by

$$g(t) = \frac{1}{1+t} \sigma(t)$$

Is the system BIBO stable? Explain.

Problem 2

ID number (last four digits)_____

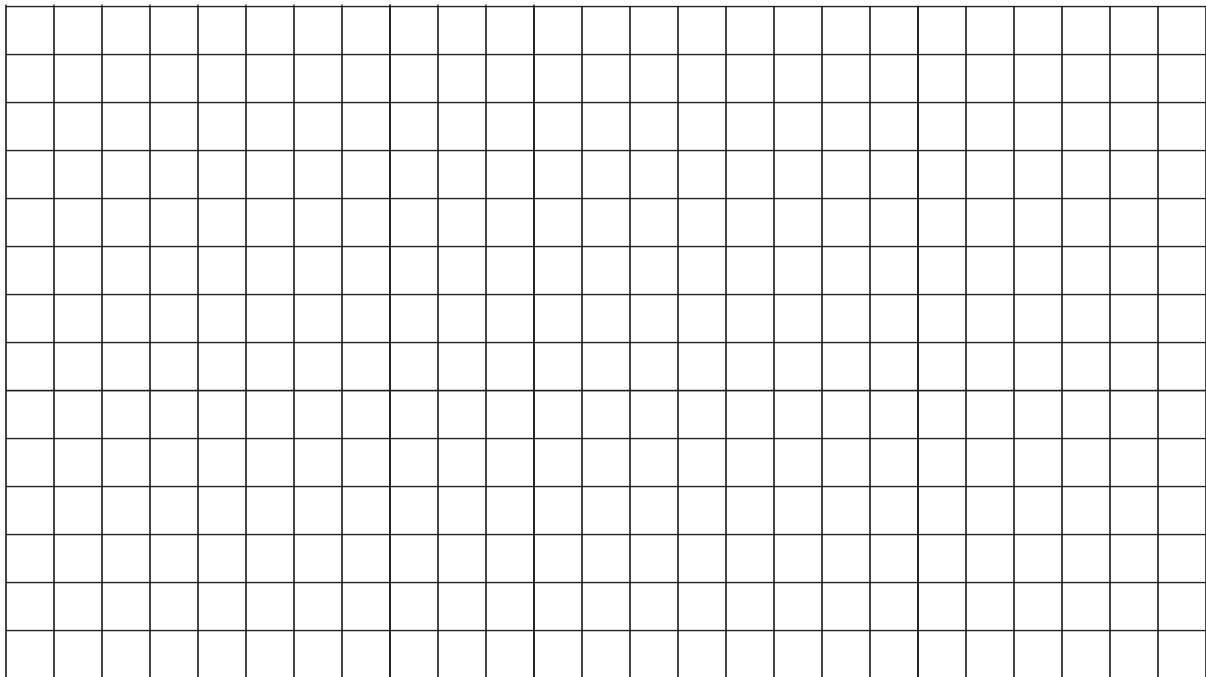
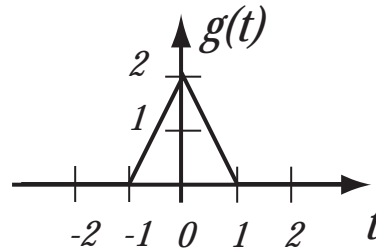
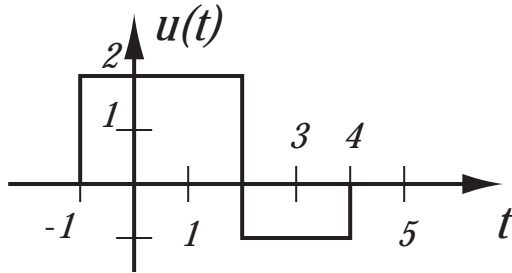
Problem 3

ID number (last four digits) _____

Given the signals $g(t)$ and $u(t)$ as plotted below, find the signal $y(t)$ given by

$$y(t) = g(t) * u(t)$$

Sketch the result in the grid below, as accurately as possible. Explain your reasoning on the page that follows. The grid squares *do not* have to represent 1 unit — you can chose the units as appropriate to plot the result. Be sure to label the axes of the grid.



Problem 3 (25%)

ID number (last four digits)_____

Problem 3

ID number (last four digits) _____

Problem 4 (25%)

ID number (last four digits)_____

Consider an LTI system G with input signal $u(t)$ and output signal $y(t)$.

1. What is the definition of the transfer function, $G(s)$?
2. Explain why the transfer function is the Laplace transform of the impulse response.

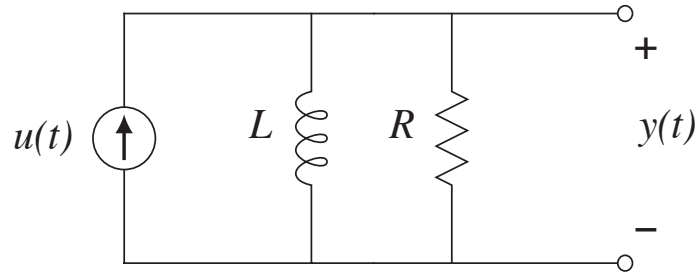
Problem 4

ID number (last four digits) _____

Problem 5 (25%)

ID number (last four digits) _____

Find the step response of the circuit below. The component values are $R = 4\Omega$, $L = 2\text{ H}$.



Problem 5

ID number (last four digits)_____