Unified Quiz S6
April 22, 2004

One 8 1/2” x 11” sheet (two sides) of notes
Calculators allowed.
Calculators may be used for arithmetic only.
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

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

$$G(s) = \frac{4}{(s + 1)^2(s + 3)}$$

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

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Problem 1

Name _____________________
Problem 2

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. Be sure to label the axes of the grid. Explain your reasoning on the page that follows.
Problem 2

Name _____________________
Problem 2

Name ______________________
Consider an LTI system $G$ with input signal $u(t)$ and output signal $y(t)$. Explain why knowing the step response of the system allows one to determine the response of the system to an arbitrary input $u(t)$. You should do more than just give the equation for $y(t)$ — you should explain why the result is true.
Problem 3

Name ___________________
Find the step response of the circuit below. The component values are \( C = 0.5 \text{ F} \), \( L = 1 \text{ H} \), and \( R = 3 \Omega \).
Problem 4

Name ____________________