

RULES

This is a closed book, closed notes test. You are, however, allowed one half of one piece of paper (front side only) for notes and definitions, but no sample problems. You must staple your equations sheet to the back of your test when you hand your test in.

You are permitted to use a calculator.

You have 50 minutes to complete the test. Please read through the entire test before starting, and read through the directions carefully. To receive partial credit, you must show your work.

There is to be absolutely no cheating. Cheating will not be tolerated.

If you have any questions, please raise your hand, and I will come to you to answer them. Do not hesitate to ask questions.

Problem	Value	Score
1	20	
2	5	
3	24	
4	20	
5	31	
Total	100	

PROBLEM 1

(20 Points)

A. Given that

$$x(t) = e^{-t}u(t)$$

plot the following signal. Clearly label all the important points. Plot from $t = -10$ to $t = 10$.

$$y(t) = x(t) + x(-t)$$

(10 Points)

B. Plot the following signal. Clearly label all the important points. Plot from $n = -10$ to $n = 10$.

$$x[n] = 5 \cos(\pi n) (u[n] - u[n - 5]) + n \delta[n + 6]$$

(10 Points)

PROBLEM 2

(5 Points)

The following continuous-time signal is to be sampled.

$$x(t) = 10\cos(20t) + 11\sin\left(100t + \frac{\pi}{2}\right)$$

Determine the Nyquist rate, f_{NS} , for sampling this signal.

PROBLEM 3

(24 Points)

Determine the properties of the following system. Choose one property from each column, and circle the appropriate property.

$$y(t) = x(t)x(t-1)$$

<u>Column 1</u>	<u>Column 2</u>	<u>Column 3</u>	<u>Column 4</u>	<u>Column 5</u>	<u>Column 6</u>
Causal	Has Memory	Stable (BIBO)	Linear	Time Invariant	LTI
OR	OR	OR	OR	OR	OR
Non Causal	Memoryless	Unstable	Nonlinear	Time Varying	Not LTI

PROBLEM 4

(20 Points)

For the following problem, let

$$\begin{aligned}x[n] &= 3\delta[n-2] - 5\delta[n-3] + 6\delta[n-4] + \delta[n-5] \\h[n] &= \delta[n+1] + 2\delta[n-1]\end{aligned}$$

A. Sketch plots of both waveforms.

(5 Points)

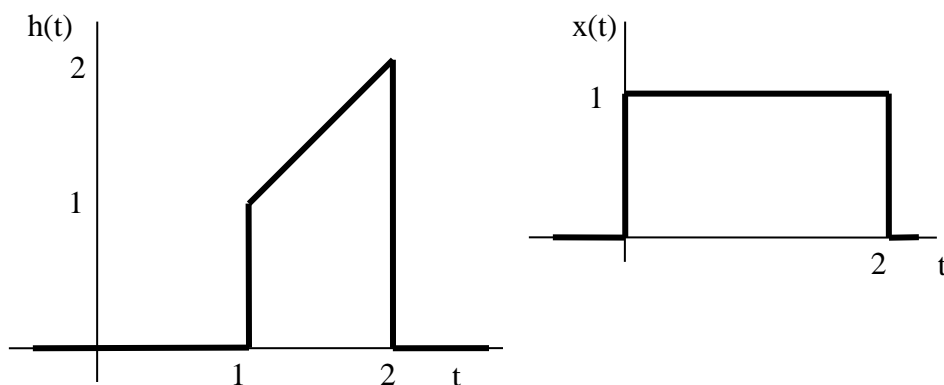
B. Determine what the output, $y[n]$, will be. Write an expression for $y[n]$ and also sketch $y[n]$.
(15 Points)

(Problem 4 Work Page)

PROBLEM 5

(30 Points)

Use the system definition, $h(t)$, and input, $x(t)$, shown below for the following problem.



A. Write an expression for $h(t)$.

(3 Points)

B. Write an expression for $x(t)$.

(3 Points)

C. What is the *mathematical definition* of the convolution integral for continuous-time convolution (i.e., provide a mathematical equation)?

(2 Points)

D. Determine the output, $y(t)$, for the given input and impulse response. You do *not* need to sketch the output. (20 Points)

(Problem 5 Work Page)

E. If you were to find $y(t)$ using Matlab, provide the line(s) of code that would be used to write the result to variable yy . Assume that the coefficients of the input and the impulse response have already been entered into the Matlab workspace and are represented by the variables xx and hh . If any necessary information is missing that is needed to find this output, describe what that information is and how it should be incorporated into your Matlab code. (3 Points)