EE 102
SPRING 1992
TEST # 1
April 22

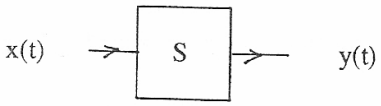
Your Name: _____
(First, Middle, LAST)

Levan

CLOSED BOOK, ALL QUESTIONS TO BE ATTEMPTED
THE QUESTIONS ARE NOT EQUALLY WEIGHTED
Time allowed: 1 Hour
Attach this sheet to your Test

QUESTION 1.

A Linear system S is described by:



$$\frac{dy}{dt} + 2\,y(t) = \frac{dx}{dt}, \quad t > 0,$$
$$y(0) = 0 = x(0),$$
$$x(t) = 0 \text{ for } t < 0.$$

(i) Solve the equation for y(t) in terms of x(t). Then show that S is TI.

(ii) Find the IRF h(t) of S.

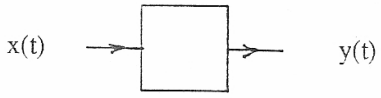
QUESTION 2.

Sketch the following signal:

$$f(t) = \delta(t - \pi/2)\cos(t + \pi/2) + 2e^{-t}\,U(t + 1)\,U(3 - t) + (-t + 2)\,U(-t + 1).$$

QUESTION 3.

Write down --*without proof*-- all the properties of the systems with the following input-output relations:



(i) $y(t) = x(t)\,t + \int_{-\infty}^{\infty} (t - \tau)^2 U(\tau - t) x(\tau)\, d\tau.$

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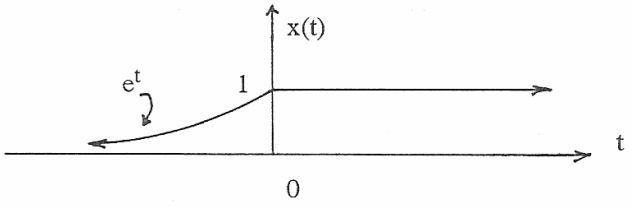
(ii) $y(t) = \int_{-\infty}^{\infty} \frac{d}{d\tau} [e^{-(t-\tau)}\ \tau\, x(\tau)]\ U(t-\tau)\, U(\tau)\, d\tau, \quad -\infty < t < \infty.$

QUESTION 4

(i) Let S_1 be L, TI and Causal. Given:

$U(t-2) \rightarrow [S_1] \rightarrow U(t-2) - (1/2)\,(t-2)^2\, U(t-2).$

Find the IRF $h_1(t)$ of S_1 then compute its output $y(t)$ when the input $x(t)$ below is applied to it:



(ii) System S_1 is now cascaded with a second system S_2 described by:

$a(t) \rightarrow [S_2] \rightarrow b(t)$

$$b(t) = \int_{-\infty}^{t} e^{-(t-\tau)}\, a(\tau)\, d\tau, \quad -\infty < t\,.$$

Find the IRF $h_{12}(t)$ of the cascaded system S_{12}. Would you say that $h_{12}(t) = h_{21}(t)$? Why or why not?