**EE120, Spring/1998**
**exam #1**
**Professor Lau**

This is a closed book, closed-notes exam. You are allowed one double-sided 8.5" x 11" handwritten crib sheet. No calculators. There are four problems. Please make sure you have all the problems. Each problem is work 20 points.

## Problem #1 (5 points each)

Determine if each of the following signals is periodic. If it is periodic, determine its fundamental period.

(a) $x(t) = 5\sin(t + \pi^{1/2})$

Periodic? _____ Fundamental period = _____

(b) $x(t) = \exp[j(t^2 + 2t)]$

Periodic? _____ Fundamental period = _____

(c) $x(t) = \sin(|3t|)$

Periodic? _____ Fundamental period = _____

(d) $x(t) = \sin^2(|3t|)$

Periodic? _____ Fundamental period = _____

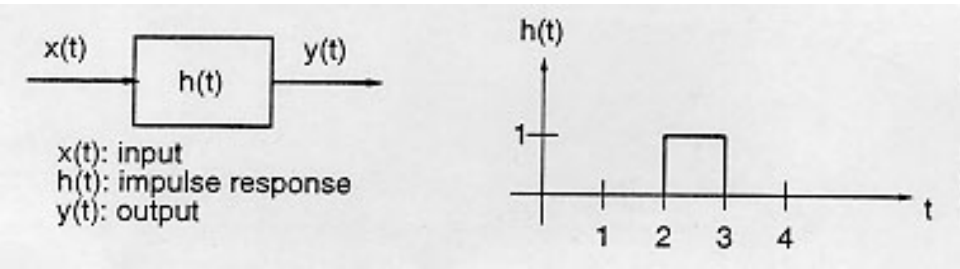
## Problem #2 (4 points each)

Determine if each of the following systems is i) linear, ii) time invariant. Mark the box with either a **Y** or **N**. Empty or illegible answers will be marked wrong.

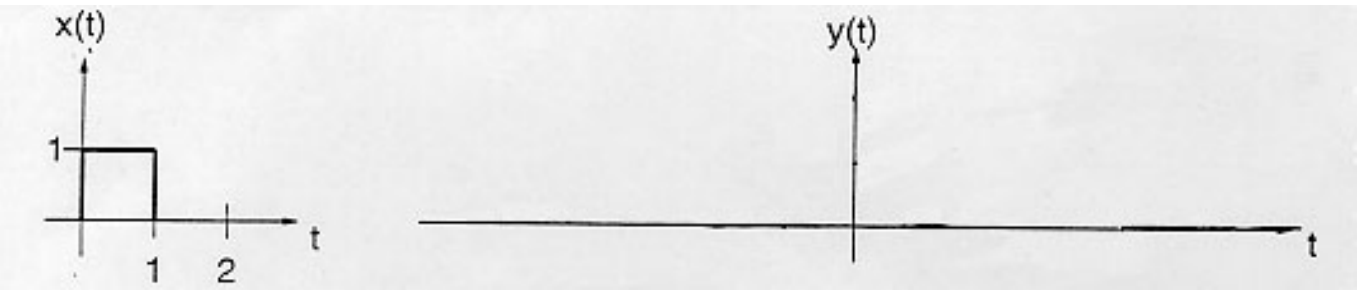
| | Linear? | Time Invariant? |
|---|---|---|
| a) $y(t) = sin(x(t))$ | | |
| b) $y(t) = \|x(t)\|$ | | |
| c) $y(t) = x(\|t\|)$ | | |
| d) $y(t) = x(t)u(t)$ | | |
| e) $y(t) = \int_{-\infty}^{t} e^{-(t-\tau)}x(\tau)d\tau$ | | |

## Problem #3 (10 points each)

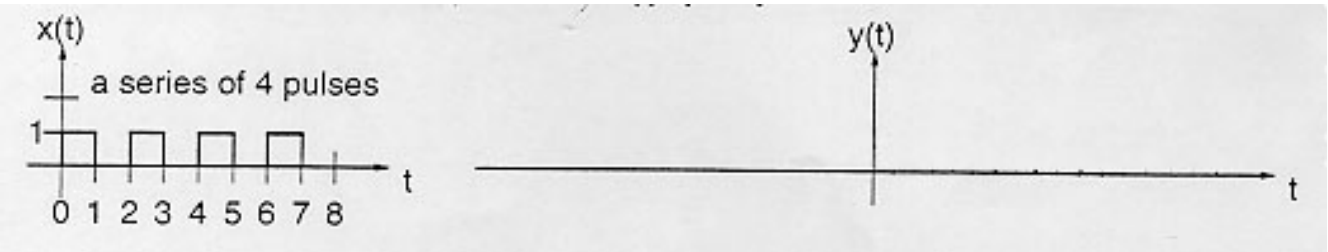
Given this LTI system, with the impulse response *h*(t):




(a) Given x(t) below, sketch y(t). Please label appropriately.

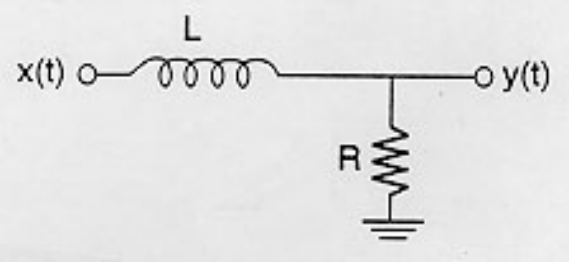


(b) Given x(t) below, sketch y(t). Please label appropriately.




**Problem #4 (6 + 7 + 7 points)**

Given the circuit below,




a) Derive the differential equation relating x(t) and y(t).

Note: voltage across the inductor = L *di/dt*

b) Find the impulse response $h(t)$.

c) Find the step response $s(t)$.

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