Department of Electrical Engineering and Computer Sciences

EECS 120

, Professor K.M.Kahn

Midterm 1

Wednesday, October 6, 1999, 2:10-3:10 PM
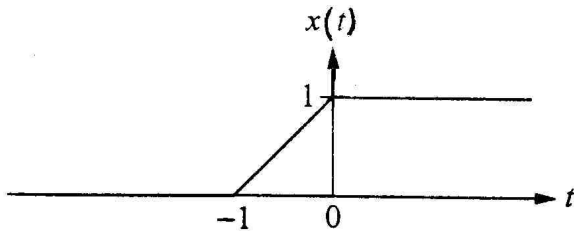
Note: indicate your answer clearly by circling it or drawing a box around it.

Problem 1

(30 pts.) Consider the CT, LTI system with input x(t) and output y(t) governed by the

differential equation: dy/dt + y(t) = dx/dt

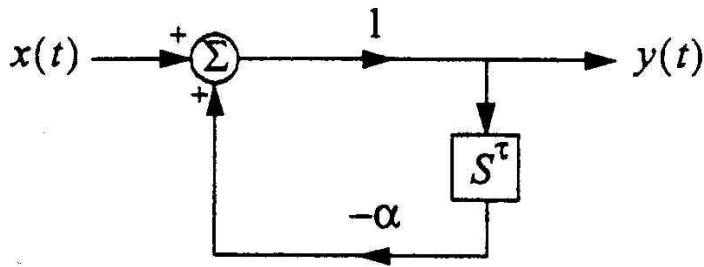 a. (5 pts.) What type of system is this? (For example, "third-order lowpass filter".)

(b) (20 pts.) Suppose the input x(t) is as shown. Find an expression for the output y(t).

(c) (5 pts.) Sketch the output y(t), labeling the horizontal and vertical axes.

Problem 2
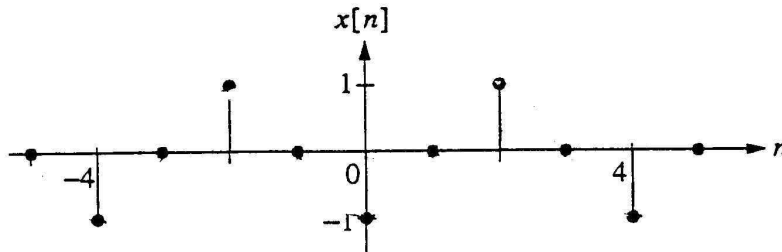
(25 pts.) Consider the following CT, LTI system. Note that y(t) = x(t) - alpha*y(t - tau).

a. (15 pts.)Find an expression for the frequency response H(j*omega) (which is valid for |alpha| < 1).

(b) (10 pts.) Suppose the input is x(t)= -1 for all t. Find the expression for the output y(t).
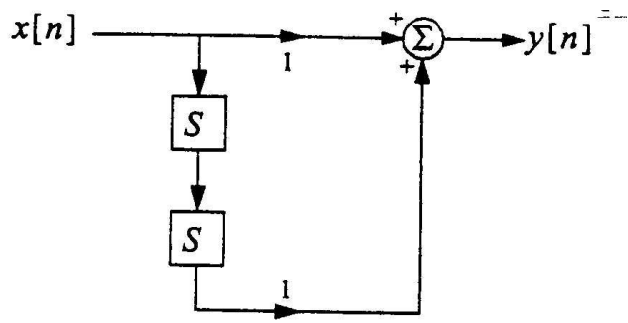
Problem 3

(25 pts.) Consider the following periodic DT signal x[n].

a. (15 pts.) Specify the period N, the fundamental frequency omega-nought and the DTFS coefficients X[k] for all k. Hint: express x[n] in simple functional form.

(b) (10 pts.) Sketch |X[k]| and arg{X[k]} for 0 <= k <= 4. Be sure to label the vertical axes.

Problem 4

(20 pts.) Consider the DT, LTI system shown. Note that $y[n] = x[n] + x[n-2]$.

$x[n]$ ⟶ Σ ⟶ $y[n]$

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a. (10 pts.) Find the expression for the frequency response H(exp(j*omega)).

(b) (10 pts.) Give an example of a periodic input signal x[n] (other than x[n] = 0 for all n) such that y[n] = 0 for all n.