Math 237

Applications of transforms to digital systems.

1. Use the Laplace Transform to solve the following ordinary differential equation

$$4y'' + y' - 3y = 2e^{-5t}$$

with the initial conditions $y'(0) = 0, y(0) = 1$.

(20 Marks)

2. Using the Heaviside function, find the Laplace Transform of the signal defined by

$$x(t) = \begin{cases} 4 - t & 0 \leq t < 3 \\ t^3 & 3 \leq t < 5 \\ t - 2 & 5 \leq t \end{cases}$$

(10 Marks)

3. Use the convolution theorem to find the inverse Laplace Transform of

$$\frac{5}{s^2(s+2)}$$

(10 Marks)

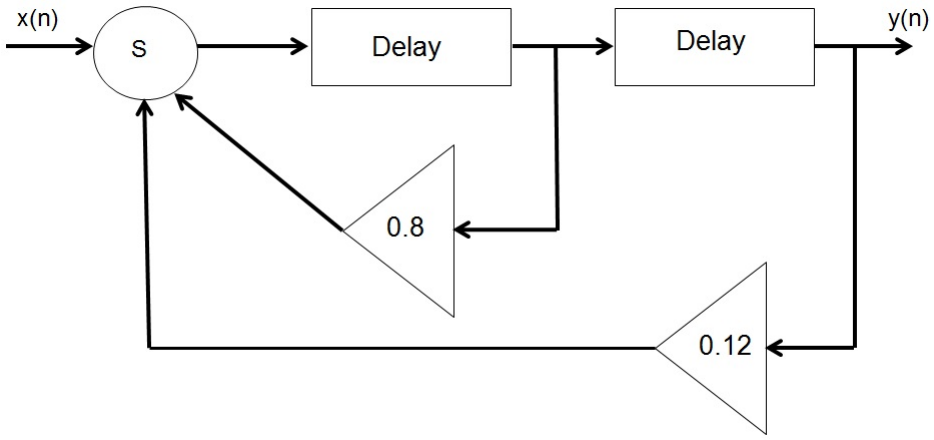
4. A signal is defined by:

$$x(t) = \begin{cases} t^3 & -2 < t < 0 \\ 0 & 0 \leq t \leq 2 \\ t + 2 & 2 \leq t \leq 4 \end{cases}$$

Use the integral definition of the Fourier Transform to find the transform of the signal.

(20 Marks)

5. The diagram below represents a negative feedback loop.



   (a) Find the transfer function for the system and investigate its stability.

   (10 Marks)

   (b) Find the impulse responce for this system.

   (15 Marks)

   (c) Find the system responce to an input of $x(n) = 3^n$ and evaluate the input and output for the first 5 samples.

   (15 Marks)

Coursework Deadline: **Thursday 1st November 3pm** to be submitted via the Faculty Office.