

## Homework No. 6

Due 17:10, May 8, 2008

**1. Use the tables of transforms and properties to find the Fourier transforms of the following signals: (20%)**

(a)  $x(t) = \int_{-\infty}^t \frac{\sin(2\pi\tau)}{\pi\tau} d\tau.$

(b)  $x(t) = \left(\frac{\sin(t)}{\pi t}\right) * \frac{d}{dt} \left[\frac{\sin(2t)}{\pi t}\right].$

**2. Use the tables of transforms and properties to find the inverse Fourier transforms of the following signals: (30%)**

(a)  $X(w) = \frac{jw}{(1+jw)^2}.$

(b)  $X(w) = \frac{2\sin(w)}{w(jw+2)}.$

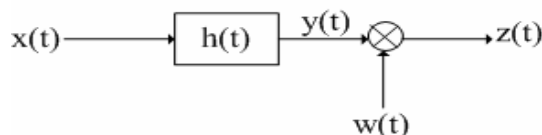
(c)  $X(w) = \frac{d}{dw} \left[ 4\sin(4w) \frac{\sin(2w)}{w} \right].$

**3. Determine the frequency response and the impulse response for the systems described by the following differential equations: (20%)**

(a)  $\frac{d}{dt} y(t) + 3y(t) = x(t)$

(b)  $\frac{d^3}{dt^3} y(t) - 3\frac{d}{dt} y(t) - 2y(t) = 3\frac{d^2}{dt^2} x(t) + 8\frac{d}{dt} x(t) - 10x(t)$

**4. Consider the system depicted below. Note that  $h(t)$  is the impulse response of an LTI system. (20%)**



**We have**  $h(t) = \frac{2\cos(4\pi t)\sin(\pi t)}{\pi t}$ ,  $x(t) = \sum_{k=0}^3 \frac{2}{1+k} \cos(k2\pi t)$  **and**  $w(t) = 2\cos(4\pi t)$ .

(a) **Find and sketch the FT of  $h(t)$ .**

(b) **Find and sketch the FT of  $x(t)$ .**

(c) **Find and sketch the FT of  $y(t)$ .**

(d) **Find  $z(t)$  and sketch the FT of  $z(t)$ .**

**5. Evaluate the following quantity: (10%)**

$$\sum_{k=-\infty}^{\infty} \frac{\sin^2(k\pi/8)}{k^2}$$