

Homework 3**Due 18:10, 12 Nov. 2009**

1. Find the impulse response and the frequency response of the systems with input $x(t)$ and output $y(t)$: (20%)

$$(1) x(t) = e^{-t}u(t), y(t) = [e^{-2t} + e^{-3t}]u(t)$$

$$(2) x(t) = e^{-2t}u(t), y(t) = 2(t-2)e^{-2(t-2)}u(t-2)$$

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

$$(1) x(t) = te^{-3|t-1|}$$

$$(2) x(t) = \sin(2\pi t)e^{-t}u(t)$$

$$(3) x(t) = \left[\frac{\sin(2\pi t)}{\pi t} \right] \left[\frac{2 \sin(3\pi t)}{\pi t} \right]$$

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

$$(1) X(\omega) = \frac{j\omega}{(1+j\omega)^2}$$

$$(2) X(\omega) = \frac{d}{d\omega} \left[4 \sin(4\omega) \frac{\sin(2\omega)}{\omega} \right]$$

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

$$(1) \frac{d}{dt} y(t) + 3y(t) = x(t)$$

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

5. Evaluate the following quantities: (10%)

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