

**Homework No. 2**  
**Due 17:10, October 28, 2010**

1. Find and sketch  $y[n] = x[n] * h[n]$  of the following the signals:

(1)  $x[n] = (-1)^n (u[n] - u[n-5])$  and  $h[n] = u[n+2]$ . (10%)

(2)  $x[n] = u[n] - u[-n]$  and  $h[n] = \begin{cases} \left(\frac{1}{2}\right)^n, & n \geq 0 \\ 4^n, & n < 0 \end{cases}$ . (10%)

2. Evaluate the following continuous-time convolution integrals: (20%)

$$y(t) = 2t^2 [u(t+1) - u(t-1)] * 2u(t+2).$$

3. Determine the homogeneous and particular solutions for the system described by the following differential equation for the given inputs and initial conditions:

$$y''(t) + 4y(t) = 3x'(t), \quad y(0^-) = -1, \quad y'(0^-) = 1$$

(1)  $x(t) = t$  (5%)

(2)  $x(t) = e^{-t}$  (5%)

(3)  $x(t) = \cos(t) + \sin(t)$  (10%)

4. Determine the homogeneous and particular solutions for the system described by the following difference equation for the given inputs and initial conditions:

$$y[n] - \frac{1}{4}y[n-1] - \frac{1}{8}y[n-2] = x[n] + x[n-1], \quad y[-1] = 2, \quad y[-2] = 0$$

(1)  $x[n] = nu[n]$  (5%)

(2)  $x[n] = \left(\frac{1}{8}\right)^n u[n]$  (5%)

(3)  $x[n] = e^{j\frac{\pi}{4}n} u[n]$  (10%)

5. Consider a system whose input  $x(t)$  and output  $y(t)$  satisfy first-order differential equation:

$$y'(t) + 2y(t) = x(t)$$

The system also satisfies the condition of initial rest; determine the system output  $y(t)$

when the input is  $x(t) = e^{3t}u(t)$ . (20%)