

Homework No. 6**Due 15:20, Jan. 2, 2013**

1. Find the Laplace transform of following signals; plot and indicate the ROC of each signal.

(1) $x(t) = -e^{-at}u(t)$ (15%)

(2) $x(t) = e^{-2t}u(t) + e^{-t} \cos(3t)u(t)$ (15%)

2. A causal LTI system with the system function described by

$$H(s) = \frac{s+1}{s^2+2s+2}.$$

Determine and sketch the response $y(t)$ when the input is

$$x(t) = e^{-|t|}, -\infty < t < \infty \text{ (20\%)}$$

3.

- (I) A system has the indicated transfer function $H(s)$. Determine the impulse response, assuming (a) that the system is causal and (b) that the system is stable.

$$H(s) = \frac{s^2+2s+2}{s^2-1} \text{ (10\%)}$$

- (II) A stable system has the indicated input $x(t)$ and output $y(t)$. Use Laplace transforms to determine the transfer function and impulse response of the system.

$$x(t) = e^{-2t}u(t), \quad y(t) = -2e^{-t}u(t) + 2e^{-3t}u(t) \text{ (10\%)}$$

4. Given the transform pair $x(t) \xleftrightarrow{L} \frac{2s}{s^2+2}$, where $x(t) = 0$ for $t < 0$,

Determine the Laplace transform of the following time signals:

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

(2) $e^{-3t}x(t)$ (5%)

(3) $x(t) * \frac{d}{dt}x(t)$ (5%)

(4) $\int_0^t x(3\tau) d\tau$ (5%)

5. For the following integral, specify the value of the real parameter σ which ensure that the integral converges:

$$\int_{-\infty}^{\infty} e^{-10|t|} e^{-(\sigma+j\omega)t} dt \text{ (10\%)}$$