# Homework No. 7
## Due 15:10, June 3, 2009

1. Find the Laplace transform of following signals;indicate the ROC of each signal with figure also.

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

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

2. The system function of a causal LTI system.

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

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

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

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.

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

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

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

4. Given the transform pair $x(t) \xleftrightarrow{L} \dfrac{2s}{s^2 + 2}$ , 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) $x(t) * \dfrac{d}{dt}x(t)$ (5%)                   (4) $\int_0^t x(3\tau)d\tau$ (5%)

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

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