EE 3054 - Quiz 11 Fall 2012

1) Use the Laplace transform to find the convolution of f(t) and g(t) where

$f(t) = 2 \exp(-2t)\, u(t)$ $g(t) = \exp(-3t)\, u(t)$

2) An LTI system is defined by the differential equation

$$2\, y''(t) + 4\, y'(t) + 6\, y(t) = 4\, x'(t) + 2\, x(t)$$

a) Find the transfer function H(s)
b) Find output signal y(t) when the input is x(t) = 3.

3) Find the Laplace transform of the signal

$x(t) = 3 \exp(-t)\, u(t-2)$

Also find the region of convergence of X(s).

4) A causal LTI system is defined by the differential equation

$$y''(t) + 5\, y'(t) + 6\, y(t) = x'(t) + 2\, x(t)$$

a) Find the impulse response h(t).
b) Sketch the pole-zero diagram of the system.
c) Find the dc gain of the system

5) Describe in plain language the meaning of 'dc gain' of an LTI system. Describe how you would find the 'dc gain' of an unknown LTI system if you are allowed to present just one signal as input to the system.

6) The impulse response of an LTI system is given by

$h(t) = \exp(-t)\, u(t) + 2 \exp(-2t)\, u(t) + \delta(t)$

Find the differential equation of the system.

7) Two LTI systems, H1 and H2, are connected in parallel, i.e.

$x(t) \rightarrow H1 \rightarrow f(t)$
$x(t) \rightarrow H2 \rightarrow g(t)$
Output of system is $y(t) = f(t) + g(t)$

The equivalent (total) system is denoted H
$x(t) \rightarrow H \rightarrow y(t)$

H1 and H2 are described by the differential equations:
H1 : $f'(t) + f(t) = x(t)$
H2 : $2\, g'(t) + g(t) = x(t)$

Find the differential equation for the total system H.