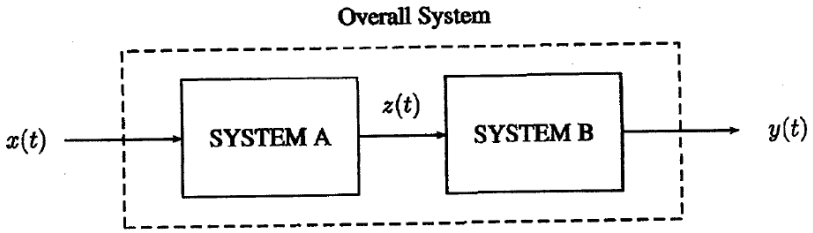
AMERICAN UNIVERSITY OF BEIRUT
ELECTRICAL AND COMPUTER ENGINEERING DEPARTMENT

EECE 440 SIGNALS AND SYSTEMS February 26, 2007
Prof. Kabalan Short-Quiz II-Solution

Consider the following system depicted below



The input-output relation for **System A** us characterized by the following causal D.E.

$$\frac{dz(t)}{dt} + 6z(t) = \frac{dx(t)}{dt} + 5x(t).$$

And the impulse response $h_b(t)$ for **System B** is defined as:

$$h_b t) = e^{-10t}u(t)$$

a. What is the Transfer function of System A. (2 pts)

$$\frac{Z(s)}{X(s)} = \frac{s+5}{s+6} = H_a(s)$$

b. Determine the Transfer function of the complete system. (2 pts)

$$H_b(s) = \frac{1}{s+10}$$

$$H(s) = H_a(s) \cdot H_b(s) = \frac{s+5}{(s+6)(s+10)}$$

c. Determine the impulse response, h(t), for the complete system.

$$H(s) = \frac{-0.25}{(s+6)} + \frac{1.25}{(s+10)} \quad (2 \text{ pts})$$

$$h(t) = (-0.25e^{-6t} + 1.25e^{-10t})u(t) \quad (2 \text{ pts})$$

d. What is the Differential equation that relates x(t) to y(t)? (2 pts)

$$\frac{d^2y(t)}{dt^2} + 16\frac{dy(t)}{dt} + 60y(t) = \frac{dx(t)}{dt} + 5x(t)$$