Serial # 0

-1 points for not writing your serial number

King Fahd University of Petroleum & Minerals
Electrical Engineering Department
EE207: Signals and Systems (081) **Dr. Ali Muqaibel**
Quiz 2: Signal and System in Time Domain

Name: KEY ver. 1

1. Is the following system linear or non linear prove your answer?

$$\frac{d^2y(t)}{dt^2} = x(t) + 100$$

It is not linear.
if you multiply by 2
if it is linear.
2 x(t) should results in 2y(t)

$$\frac{2d y(t)}{dt^2} = 2x(t) + 200 \quad -(1)$$

$$\frac{2\, dy(t)}{dt^2} = 2x(t) + 100 \quad -(2)$$

Eq. (1) & (2) Cannot be both correct.

Also it is not in the fixed ODE format.

2. Is the following system fixed? *justify your answer* $5y(t)=5x(t)+5t$

No. The system is not fixed. The time change is excplect.

$y(t) = x(t) + t$

at $t=0$ $y(t) = x(t)$
at $t=1$ $y(t) = x(t)+1$

the relation between the input & out put varies with time.

3. The Impulse response of an LTI system is given by the following

$$h(t) = 3e^{-10t}u(t)$$

Find the output when the input is $x(t) = 5\delta(t)+u(t)+2e^{-2t}u(t)$

Since the system is linear. we can find the output to the individual terms.

$5\delta(t) \rightarrow 5h(t) = 15e^{-10t}u(t)$

$u(t) \rightarrow a(t) = \int_{-\infty}^{t} h(\tau)\,d\tau$

$\Rightarrow a(t) = \int_{-\infty}^{t} 3e^{-10\tau}u(\tau)\,d\tau = \begin{cases} 0 & t<0 \\ 3\int_0^t e^{-10\tau}d\tau \end{cases}$

$u(t)\left[-\frac{3}{10}e^{-10\tau}\Big|_0^t\right] = \frac{-3}{10}\left[e^{-10t}-1\right]u(t)$

$a(t) = \frac{3}{10}\left[1-e^{-10t}\right]u(t)$

last term by convolution.

$y(t) = \int_{-\infty}^{\infty} h(\tau)x(t-\tau)\,d\tau$

$= \int_{-\infty}^{\infty} 3e^{-10\tau}u(\tau)\cdot 2e^{-2(t-\tau)}u(t-\tau)\,d\tau$

$6\int_0^t e^{-8\tau-2t}\,d\tau$ $\quad \begin{cases} 0 & t<0 \\ \dots & t>0 \end{cases}$

$-\frac{6}{8}\left[e^{-8\tau-2t}\right]_0^t$

$= -\frac{3}{4}\left[e^{-10t} - e^{-2t}\right]u(t)$

Sum
$y(t) = \left[15e^{-10t} + \frac{3}{10} - \frac{3}{10}e^{-10t} - \frac{3}{4}e^{-10t} + \frac{3}{4}e^{-2t}\right]u(t)$

$= \left[\frac{3}{10} + \frac{3}{4}e^{-2t} + \left(15-\frac{3}{10}-\frac{3}{4}\right)e^{-10t}\right]u(t)$

Knowledge is what remains after school Good Luck