جامعة بيرزيت

BIRZEIT UNIVERSITY

Electrical and computer Engineering

Signals and Systems

Quiz (2)

Name: Key ID:

1) Find impulse response of a system described by the following linear constant coefficient differential equation:

$$\frac{d^2y}{dt^2}+4\frac{dy}{dt}+3y(t)=2\frac{dx}{dt}+8x(t)$$

$\lambda^2+4\lambda+3=0$

$(\lambda+3)(\lambda+1)=0 \Rightarrow \lambda_1=-3,\ \lambda_2=-1$

So, $y_{zi}=c_1e^{-t}+c_2e^{-3t}$

I.C. $y_0(0)=0$, $\dot{y}_0(0)=1$

$c_1+c_2=0$

$\dot{y}_0=-c_1e^{-t}-3c_2e^{-3t}$

$\dot{y}_0(0)=-c_1-3c_2=1$

$-c_1+3c_1=1$

$2c_1=1 \Rightarrow c_1=\frac{1}{2}$

$c_2=-\frac{1}{2}$

$h(t)=[P(D)y_0(t)]u(t)$

$=(2D+8)\left(\frac{1}{2}e^{-t}-\frac{1}{2}e^{-3t}\right)$

$=\left(-e^{-t}+3e^{-3t}+4e^{-t}-4e^{-3t}\right)u(t)$

$=\left(3e^{-t}-e^{-3t}\right)u(t)$

2) The impulse response, h(t), of an LTI system is shown in figure below. If this system is excited with an input signal x(t), as shown in the figure, find its output y(t)?

Graphically

$t<-1 \Rightarrow y(t)=0$

$-1<t<0 \Rightarrow y(t)=t+1$

$0<t<5 \Rightarrow y(t)=1$

$5<t<6 \Rightarrow y(t)=-t+6$

$t>6 \Rightarrow y(t)=0$