國立台灣科技大學九十六學年度碩士班招生試題

系所組別： 電機工程系碩士班乙一組

科　　目： 信號與系統

總分 100 分，請依序作答。

1. Compute the Fourier transform of the following signals. (Where $u(t)$ is the unit-step function)

   (a) $x(t) = (e^{-t}\cos(4t))\,u(t)$ (10%)

   (b) $x(t) = t\,e^{-2t}u(t)$ (10%)

2. A linear time-invariant continuous-time system has frequency response function $H(\omega) = j\omega\,e^{-j\omega}$. The input $x(t) = \cos(\pi t)$ is applied to the system for $-\infty < t < \infty$.

   (a) Determine the input spectrum $X(\omega)$ and the corresponding output spectrum $Y(\omega)$. (10%)

   (b) Compute the output response $y(t)$. (10%)

3. A continuous-time signal $x(t)$ has the Laplace transform

$$X(s) = \frac{s+1}{s^2+5s+7}$$

   Determine the Laplace transform V(s) of the following signals.

   (a) $v(t) = x(t)^* x(t)$. (5%)

   (b) $v(t) = x(t)\sin(2t)$. (5%)

國立台灣科技大學九十六學年度碩士班招生試題

系所組別： 電機工程系碩士班乙一組

科　　目： 信號與系統

4. Suppose that the digital filter system is defined by the following I/O relation:

$$y[n] = x[n] + 2x[n-1] + x[n-2]$$

(a). Write the impulse response of this system (5%)

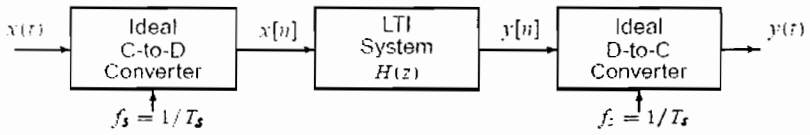
(b). Write the frequency response of this system. (5%)

(c). Sketch a plot of the magnitude of the frequency response (5%)

(d). Sketch a plot of the magnitude of equivalent continuous-time frequency response $H(j\omega)$ of this system while the input digital signal x[n] is sampled at sampling frequency of 1000Hz (5%)

(e). Write the Z-domain description of this system (i.e. H(z)) , and plot the poles and zeros of H(z) in the complex z-plane. (5%)

5. Consider the following system for sampling, filtering and reconstruction of a continuous-time signal:



(C-to-D: Continuous to discrete, D-to-C: Discrete to continuous)

Where the LTI system function is $H(z)=7z^{-2}$, and the continuous-time input signal is $x(t)=3\cos(3000\pi t-3\pi/5)$

(a) Plot the complete frequency spectrum for x[n] in the region $-\pi < \hat{\omega} \le \pi$ ($\hat{\omega}$:digital frequency) for the case where sampling frequency f_s=2000 Hz (5%)

(b) Determine an expression for the output y(t) of this system for the input x(t) for the case where sampling frequency f_s=2000 Hz (5%)

(c) Determine an expression for the output y(t) for the same input signal if the sampling frequency is increased to f_s=4000 Hz (5%)

6.

For each of the following system determine if they are (1)linear (2) time-invariant (3) causal

(a) y[n]=nx[n] (5%)

(b) $y[n]=(x[-n])^2$ (5%)