

國立臺灣科技大學
九十二學年度碩士班招生考試試題

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. A linear time-invariant discrete-time system has the unit-pulse response

$$h[n] = e^{-n} \quad \text{for } n \geq 0 \quad (20\%)$$

- (a) Compute the unit-step response $g[n]$ for $n \geq 0$. (Express your answer in closed form)
- (b) Compute the output response $y[n]$ for $n \geq 0$ when the input is $x[n] = u[n] - u[n-3]$ with zero initial energy in the system prior to the application of the input.

2. Compute the Fourier transform of the signal $x(t) = 1/t^2$. (10%)

hint: $F\{u(t) - 0.5\} = 1/(j\omega)$

3. A modulation system is defined by $y(t) = x(t)f(t)$, sketch $Y(\omega)$ for the following signal. (10%)

$$x(t) = 0.5, \quad f(t) = \sum_{n=-\infty}^{\infty} \delta(t - n\pi).$$

4. A discrete-time signal $x[n]$ has z-transform

$$X(z) = \frac{z+1}{z(z-1)}$$

Compute $x[0]$, $x[1]$, and $x[1000]$. (10%)

5. Compute and plot the frequency spectrum of the signal $f[k] = (0.5)^{|k|}$, $k = 0, \pm 1, \pm 2, \dots$

(20%) (Express your answer in closed form)



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6. Find the inverse Laplace transform of the following function (10%)

$$F(s) = \frac{s^3 + 1}{s(s+1)(s+2)}$$

7. Consider a linear time-invariant system. The zero-state response of the system excited by $u(t) = \sin 2t$ is measured as

$$y(t) = 1 + 3\sin 2t - e^{-t} \quad (20\%)$$

- (a) What is its transfer function?
(b) What is the unit step response of the system?

