

# 國立暨南國際大學九十二學年度碩士班研究生入學考試試題

第 2 節信號與系統 適用：(電機所系統組 435)

(本試題共 2 頁，第 1 頁)

- 考生注意：1. 依次序作答，只要標明題號，不必抄題。  
2. 答案必須寫在答案卷上，否則不予計分，並限以藍黑色筆作答。  
3. 試題隨卷繳回。(餘請詳閱試場規則)

1. Is the system below linear? Time-invariant? Verify your answer.

$$y[n] = x[2n]$$

where  $x[n]$  is the input signal and  $y[n]$  is the output signal. (10%)

2. Let  $h(t)$  be the triangular pulse shown in Figure P2(a), and let  $x(t)$  be the impulse train depicted in Figure P2(b). That is,

$$x(t) = \sum_{k=-\infty}^{\infty} \delta(t - kT)$$

Determine and sketch  $y(t) = x(t) * h(t)$  for the following values of  $T$ , where "\*" is the convolution operator:

- (1)  $T=3$  (2)  $T=3/2$  (3)  $T=1$  (10%)

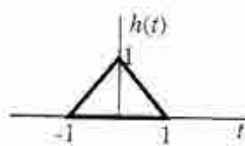


Figure P2(a)

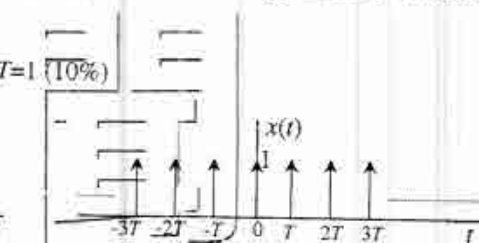


Figure P2(b)

3. Consider the discrete-time signal  $x[n] = a^n u[n]$ ;  $|a| < 1$  and  $u[n]$  is the unit step function. Find the Fourier transform  $X(e^{j\omega})$  of  $x[n]$ , and plot  $|X(e^{j\omega})|$  for  $a > 0$  and  $a < 0$ . (10%)

4.  $x(t)$  is the impulse train,

$$x(t) = \sum_{k=-\infty}^{\infty} \delta(t - kT)$$

Determine the Fourier transform of  $x(t)$ . (10%)

5. Given that  $x(t)$  has the Fourier transform  $X(j\omega)$ , express the Fourier transforms of the signals listed below in terms of  $X(j\omega)$ .

(1)  $x_1(t) = x(5-t) + x(-5-t)$  (5%)

(2)  $x_2(t) = \frac{d^2}{dt^2} x(t-1)$  (5%)

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第 2 節信號與系統 適用：(電機所系統組 435)

(本試題共 2 頁，第 2 頁)

- 考生注意：1. 依次序作答，只要標明題號，不必抄題。  
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3. 試題隨卷繳回。(餘詳閱試場規則)

6. What is Sampling Theorem? Please describe it and explain it as clear as possible. (10%)

7. A linear time-invariant system produces an output  $y(t) = [e^{-t} - e^{-2t}]u(t)$  for an input  $x(t) = e^{-t}u(t)$ , where  $u(t)$  is the unit step function.

- (1) Find the transfer function  $H(s)$  (the Laplace Transform of the impulse response) of the system. (3%)
- (2) Draw the pole-zero plot for  $H(s)$ . Is this system causal? Stable? (9%)
- (3) Specify a differential equation characterizing this system. (3%)

8. Consider the z-transform

$$X(z) = \frac{2 - \frac{1}{2}z^{-1}}{(1 - \frac{1}{2}z^{-1})(1 - 2z^{-1})}$$

Find out the corresponding time-domain signal  $x[n]$  if the region of convergence is

- (1)  $|z| > 2$  (2)  $\frac{1}{2} < |z| < 2$  (3)  $|z| < \frac{1}{2}$  (10%)

9. Consider the system as shown in Figure P9.

- (1) Write down a difference equation relating  $y[n]$  and  $x[n]$ . (5%)
- (2) Write down the transfer function  $H(z)$  for the system and draw the pole-zero plot. (7%)
- (3) Is this system stable? (3%)

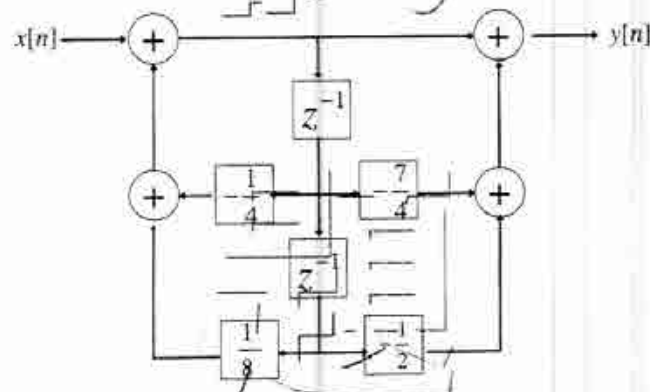


Figure P9