

# 大同大學 九十九 學年度研究所碩士班入學考試題

考試科目：通訊原理

所別：通訊工程研究所

第1頁 共1頁

註：本次考試不可以參考自己的書籍及筆記； 不可以使用字典； 可以使用計算器。

1. Determine whether or not each of the following signals is periodic. If the signal is periodic, determine its fundamental period.

(a)  $x[n] = e^{j(5\pi/2)n} + e^{j(3\pi/5)n}$ . (5%)  
 (b)  $x(t) = 3\cos(5t - \pi/4)$ . (5%)

2. The sinusoidal signal  $x(t) = A\cos(\omega_0 t + \theta)$   
 (a) Please calculate the average power. (5%)  
 (b) Please calculate the autocorrelation function,  $R_x(\tau)$ . (5%)

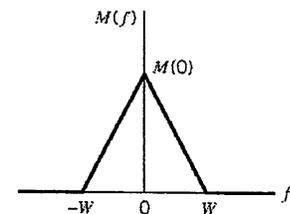
3. Let  $X(f) = \sum_{n=-2}^2 \delta(f - nf_0)$ , for  $f_0 = 10$  kHz.  
 (a) Sketch  $X(f)$ . (5%)  
 (b) Find  $x(t)$ , the inverse Fourier transform of  $X(f)$ . (5%)

4. For the five channels that have the frequency responses as given:  
 (i)  $H_1(\omega) = A \cdot e^{j\omega^2}$ . (ii)  $H_2(\omega) = |A\omega^2| \cdot e^{j\omega^2}$ . (iii)  $H_3(\omega) = 2A \cdot e^{j2\omega}$   
 (iv)  $H_4(\omega) = |A\omega| \cdot e^{j\omega}$ . (v)  $H_5(\omega) = A/2 \cdot e^{j\omega/2}$  ( $A$  is constant)  
 (a) Choose the systems that are all-pass system. (4%)  
 (b) Choose the systems that have constant envelope delay. (4%)  
 (c) Choose the systems that have constant group delay. (4%)  
 (d) Choose the systems that have constant phase delay. (4%)  
 (e) Choose the systems that are transmission distortionless. (4%)

5. Given a filter with frequency response function  $H(f) = 5/[4 + j(2\pi f)]$   
 (a) Determine the magnitude response of  $H(f)$ . (5%)  
 (b) If an input has Fourier transform  $X(f) = N_0/2$ , is applied to the filter, then obtain the energy spectral density of the output. (5%)

6. An FM modulator has output  $y_c(t) = A \cos\left[2\pi f_c t + 2\pi f_d \int^t m(\alpha) d\alpha\right]$ , if  $f_c = 2000$  Hz,  $f_d = 14$  Hz/V, and  $m(t) = 5\cos(20\pi t)$ .  
 (a) What is the peak frequency deviation? (5%)  
 (b) What is the modulation index? (5%)

7. The message signal,  $m(t)$ , has the spectrum as shown in right  
 (a) Please sketch the spectrum of the corresponding Double-sideband modulation, that is  $s(t) = Am(t) \cos 2\pi f_c t$ . (5%)  
 (b) Please sketch the spectrum of the corresponding AM signal, that is  $s(t) = (A + m(t)) \cos 2\pi f_c t$ . (5%)



8. For the two signal constellations shown in right,  
 (a) Which of these two constellations has minimum average energy? (10%)  
 (b) How to rearrange the constellation that has the larger average energy to a new constellation that differs from another one but still has minimum average energy? (10%)

