

國立臺北科技大學 102 學年度碩士班招生考試

系所組別：2220 電腦與通訊研究所乙組

第二節 通訊系統 試題

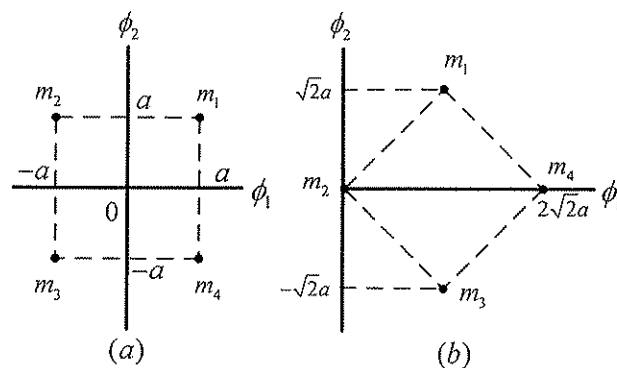
第一頁 共一頁

注意事項：

1. 本試題共 6 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (20%)
 - (1) What are the differences between coherent M-ary PSK and coherent M-ary FSK modulation schemes in essence? (8%)
 - (2) What are the advantage and disadvantage of using coherent M-ary PSK with large M? (6%)
 - (3) What are the advantage and disadvantage of using coherent M-ary FSK with large M? (6%)

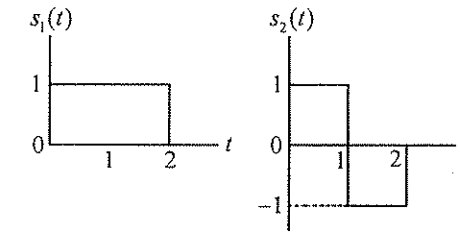
2. (15%)
 - (1) Show that the two signal constellations, as illustrated below, have the same average probability of symbol error. (8%)



- (2) Which of these two constellations has minimum average energy? Justify your answer. (7%)

3. (20%)

A pair of signals $s_1(t)$ and $s_2(t)$ is given as follows.



- (1) Construct the signal constellation for $s_1(t)$ and $s_2(t)$. (10%)
- (2) Calculate the average probability of error incurred by the maximum likelihood detection procedure applied to this form of signaling over an AWGN channel with single-sided power spectral density of 5×10^{-2} w/Hz. (10%)

4. (20%)

An angle modulated signal is given by

$$s(t) = \cos(2 \times 10^6 \pi t) \cos[6 \sin(2 \times 10^3 \pi t)] - \sin(2 \times 10^6 \pi t) \sin[6 \sin(2 \times 10^3 \pi t)].$$

- (1) Find the angle $\theta(t)$ and instantaneous frequency $f_i(t)$ of $s(t)$. (10%)
- (2) If $s(t)$ is regarded as an FM signal with frequency sensitivity of $k_f = 12 \times 10^3$ Hz/v, what is the corresponding message signal $m(t)$? (4%)
- (3) In part (2), find the maximum frequency deviation Δf and calculate its transmission bandwidth B_T using the Carson's rule. (6%)

5. (15%)

A pair of Sunde's FSK signals is given by

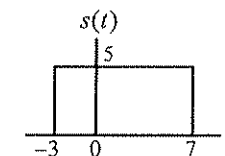
$$\begin{cases} s_1(t) = \sqrt{2} \cos(4000\pi t) & 0 \leq t \leq 2 \text{ ms} \\ s_2(t) = \sqrt{2} \cos(3000\pi t) & 0 \leq t \leq 2 \text{ ms}. \end{cases}$$

Assume that the signal with equally probable is to be transmitted over the AWGN channel with two-sided power spectral density of 2×10^{-4} w/Hz.

- (1) Plot the block diagram of the coherent BFSK receiver and determine the bit error probability for the system. (10%)
- (2) What is the transmission bandwidth (null-to-null) required for the system? (5%)

6. (10%)

A signal $s(t)$ is given as follows.



- (1) Is this a power or an energy signal? Justify your answer. (4%)
- (2) Find the Fourier transform of the signal $s(t)$ and plot its amplitude spectrum. (6%)