

# 國立臺北科技大學

九十三學年度電機工程系碩士班碩士在職專班入學考試

## 丁組：通訊原理(含專業實務) 試題

填准考證號碼

第一頁 共二頁

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### 注意事項：

1. 本試題共【6】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。

一、(20%) A given AM (DSB-LC) transmitter develops an unmodulated power output of 1kW across a 100-ohm resistive load. When a sinusoidal test tone with a peak amplitude of 5.0V is applied to the input of modulator, it is found that the spectral line for each sideband in the magnitude spectrum for the output is the 30% of the carrier line. Determine the following quantities in the output signal.

- a) (5%) The modulation index.
- b) (5%) The peak amplitude of the lower sideband.
- c) (5%) The transmission efficiency.
- d) (5%) The total power output.

二、(16%) Consider the angle modulation system with input signal  $f(t)$ .

- a) (8%) Write down the expressions for the frequency modulating waveform  $\phi_{FM}(t)$  and the phase modulating waveform  $\phi_{PM}(t)$  in terms of  $f(t)$ .
- b) (8%) Define the input signal  $f(t)$  in Figure 1. Which one is its corresponding frequency modulating waveform  $\phi_{FM}(t)$  in Figure 2 ? Which one is its corresponding phase modulating waveform  $\phi_{PM}(t)$  in Figure 2 ?

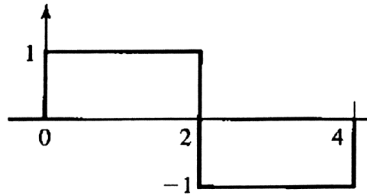


Figure 1:  $f(t)$

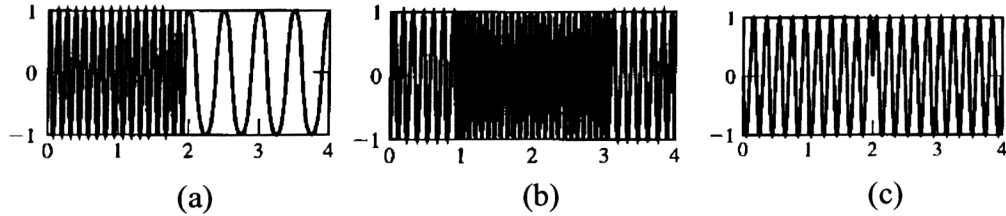


Figure 2

三、(16%) Four different message signals are to be multiplexed and transmitted. Message 1 has a bandwidth of 10kHz. Message 2 and 3 have bandwidth of 8kHz. Message 4 has a bandwidth of 7kHz. Determine the minimum bandwidth required for each method if the multiplexing /modulation method used is

- (8%) TDM, PAM.
- (8%) FDM, SSB.

四、(14%) Figure 3 are eye patterns of two systems in noiseless environment.

- (8%) Which system is better? Explaining your answer.
- (6%) Do these two systems have ISI effects? Explaining your answer.

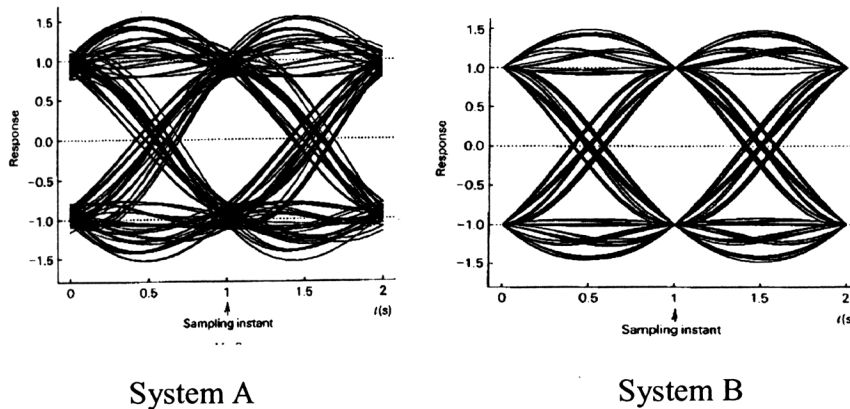


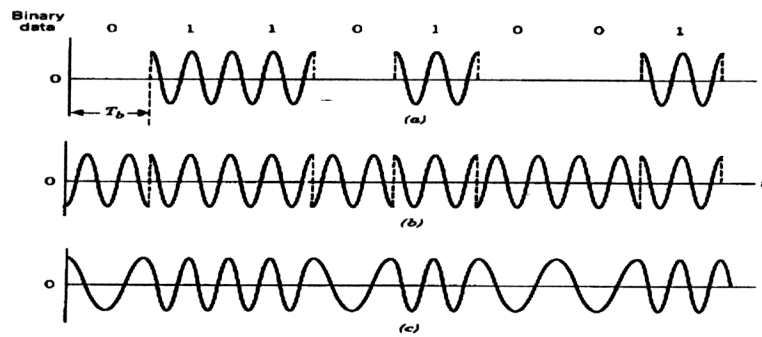
Figure 3

注意：背面尚有試題

五、 (16%) Consider the signal  $s(t)$  defined as 
$$s(t) = \begin{cases} \frac{A}{2} & 0 \leq t \leq \frac{T}{2} \\ -\frac{A}{2} & \frac{T}{2} < t \leq T \\ 0 & \text{else} \end{cases}$$

- (8%) Determine the impulse response of a filter matched to this signal and sketch it as a function of time. (Assume that the matched filter is sampled at  $t = T$ .)
- (8%) Find the peak value of the matched filter's output.

六、 (18%) Consider the binary digital modulation waveforms in the following figure.



- (9%) Which one is FSK? Which one is ASK? Which one is PSK?
- (9%) Find the bit error rate of these systems in based on the same average transmitting power  $E_b$ . (Assumed that two symbols are equally likely, transmitting in AWGN channel with noise power spectral density  $N_0/2$ , and detecting by coherent detectors. You may assume  $p_e = \frac{1}{2} \operatorname{erfc} \left( \frac{d}{2\sqrt{N_0}} \right)$  where  $d$  is the Euclidean distance of two signal vectors in the signal space diagram.)