

# 國立臺北科技大學 101 學年度碩士班招生考試

系所組別：2140 電機工程系碩士班丁組

## 第一節 通訊原理 試題

第一頁 共一頁

### 注意事項：

1. 本試題共五題，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。

一、(20%)

Let  $X(t)$  be a stationary random process with auto-correlation function  $R_X(\tau)$ .

Let  $X_1(t) = X(t)\cos(2\pi f_c t + \Theta)$  and  $X_2(t) = X(t)\sin(2\pi f_c t + \Theta)$ , where the

probability density function of  $\Theta$  is  $f_\Theta(\theta) = \begin{cases} \frac{2}{\pi}, & -\frac{\pi}{4} \leq \theta < \frac{\pi}{4}, \\ 0, & \text{elsewhere.} \end{cases}$  If  $X(t)$  and

$\Theta$  are independent, calculate the cross-correlation function of  $X_1(t)$  and  $X_2(t)$ .

二、(20%)

Figure P-2 shows the spectrum of a message signal  $m(t)$ . The signal is sampled at a rate equal to 2 KHz using flat-top pulses, with each pulse being of unit amplitude and duration 0.1 ms. Determine and sketch the amplitude spectrum of the resulting sampled signal.

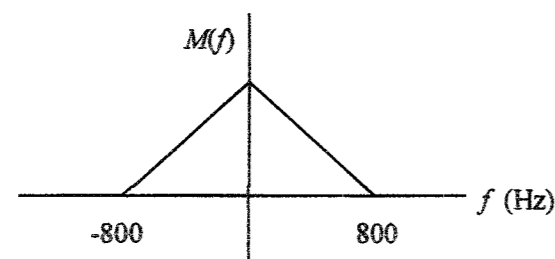


Figure P-2

三、(20%)

At the quadrature-carrier demultiplexer, please explain the procedure of extracting  $m_1(t)$  and  $m_2(t)$  from the multiplexed signal  $s(t) = m_1(t)\cos(2\pi f_c t) + m_2(t)\sin(2\pi f_c t)$ .

四、(20%)

Consider a linear time-invariant system with impulse response  $2 \operatorname{sinc}^2(2t)$ , where

$\operatorname{sinc}(x) = \frac{\sin(\pi x)}{\pi x}$ . If  $\operatorname{sinc}(4t)$  is the input signal, find the output signal.

Hint: This problem should be solved in the frequency domain.

五、(20%)

Consider a channel the output of which, in response to a signal,  $s(t)$ , is defined by  $x(t) = a_1 s(t-t_1) + a_2 s(t-t_2)$ . It is proposed to use a four-tap delay-line-filter as shown in Figure P-5 to equalize the multipath distortion produced by this channel. Please evaluate the parameters of the filter in terms of  $a_1, a_2, t_1$ , and  $t_2$ , assuming  $a_2 \ll a_1$  and  $t_2 > t_1$ .

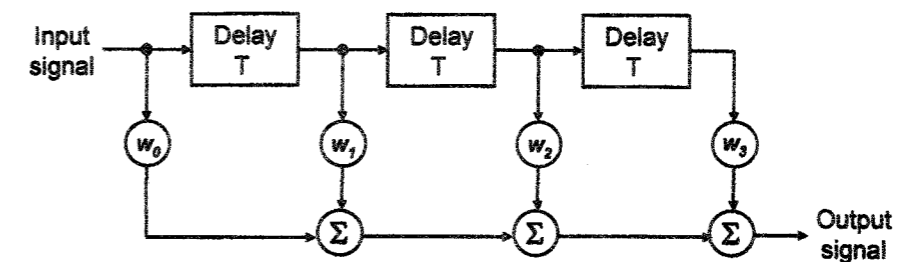


Figure P-5