國立臺北科技大學九十七學年度博士班招生考試

系所組別：2140 電機工程系博士班丁（通訊）組

第一節　通訊原理　試題

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. (15%) Consider the block diagram of modulators in Figure 1. Assuming that $kf(t) << 1, k\int f(\tau)d\tau << 1$, explaining which ones are corresponding to narrowband FM、narrowband PM and AM(DSB-LC).

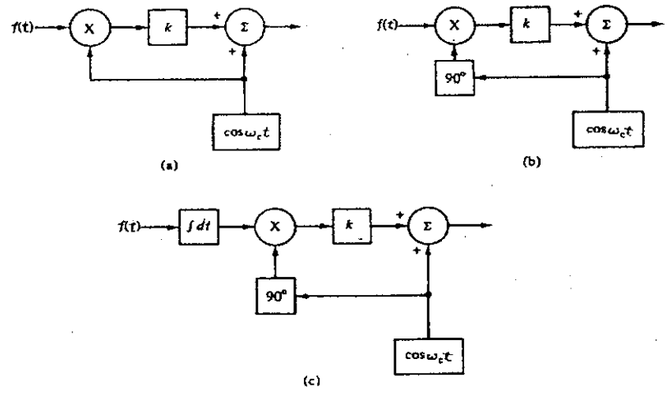


Figure 1

2. $f(t)$ is a limited bandwidth signal with bandwidth of 10 kHz. Now transmit this signal using SSB method with carrier frequency of 10MHz. This modulating signal is received by a superhetetrodyne receiver whose local oscillator operates at a frequency f_0 above the incoming signal. The IF amplifier passes all frequency components in the range 3MHz-3.01MHz(assume ideal). Following the IF amplifier is a product detector operating at a frequency f_d. Determine the frequency f_0, f_d . If
   (a) (10%) it is upper sideband transmission.
   (b) (10%) it is lower sideband transmission.

3. $f(t)$ is a band-limited signal with Fourier transform $|F(f)| = 0$ for $|f| \geq f_m$. This signal is sampled by an ideal periodic pulse function $p_T(t) = \sum_{n=-\infty}^{\infty} p(t - mT_s)$ where $p(t) = \begin{cases} 1 & |t| \leq T/2 \\ 0 & \text{else} \end{cases}$ and $T < T_s$.
   (a) (10%) Find the Fourier transform of the sampled signal $f_s(t) = f(t)p_T(t)$.
   (b) (8%) Show that the original signal $f(t)$ can be recovered from the sampled signal $f_s(t) = f(t)p_T(t)$ by passing it through an ideal low pass filter with transfer function $H(f) = \begin{cases} 1 & |f| < f_s/2 \\ 0 & \text{else} \end{cases}$ if $f_s \geq 2f_m$ where $f_s = 1/T_s$.

4. (13%) Given a digital communication system as figure 2. What is the modulation method used in this system? (BFSK, BASK, BPSK, or QPSK). Is this a coherent or noncoherent system?

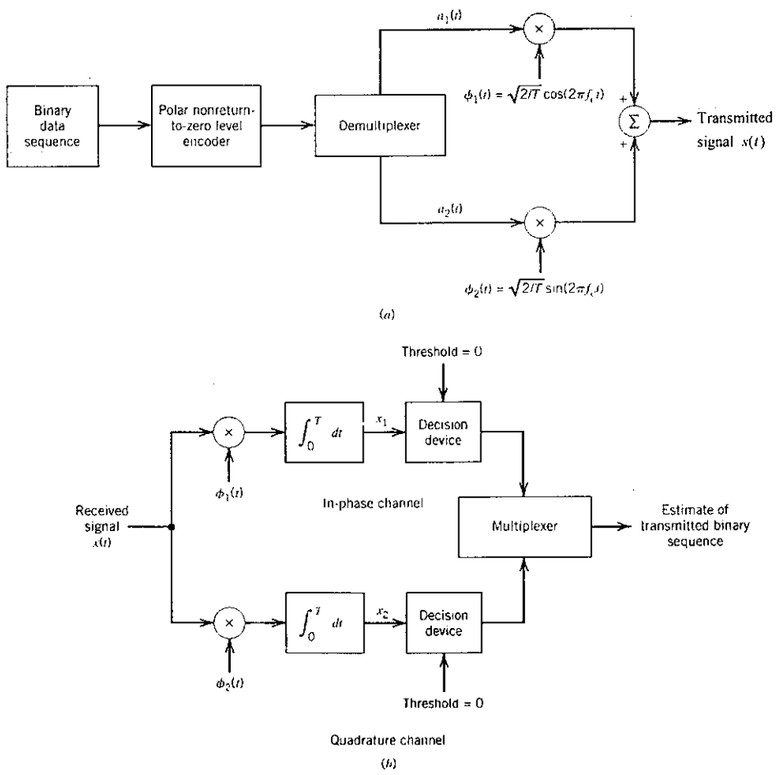


Figure 2

注意：背面尚有試題

5. Consider the signal s(t) which is defined as $s(t)=\begin{cases} A & 0 \le t \le 3T_b/4 \\ -A & 3T_b/4 < t \le T_b \\ 0 & \text{else} \end{cases}$

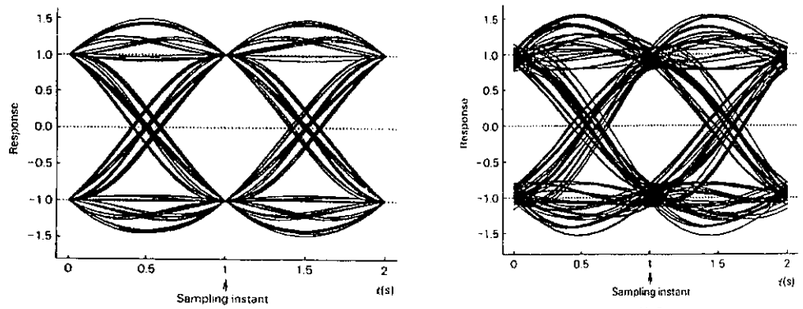
   (a) (10%) Determine the impulse response of a filter matched to this signal and sketch it as a function of time.

   (b) (8%) Find the peak value of the output of the matched filter.

6. System A and system B have eye patterns as figures 3 in noiseless channel:

   (a) (8%) Which system is better? Explaining.

   (b) (8%) Do these two systems have ISI effects? Explaining.



System A

System B

Figure 3