國立高雄第一科技大學 100 學年度 碩士班 招生考試 試題紙

系 所 別：電腦與通訊工程系　　組　別：通訊組

考科代碼：2212　　考　科：通訊原理

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注意事項：

1、本科目可使用本校提供之電子計算器。

2、請於答案卷上規定之範圍作答，違者該題不予計分。

1. (15 %).

(a) Find the inverse Fourier transform $x(t)$ for the spectrum function $X(f)$ in Fig. 1.

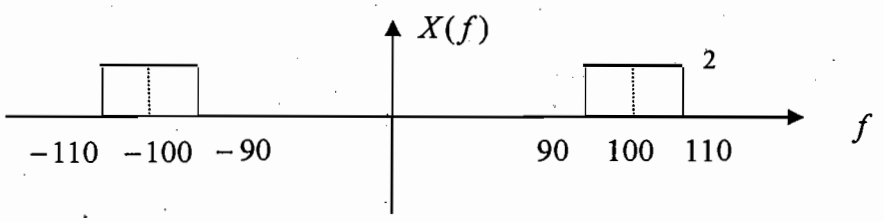

Fig. 1

(b) Evaluate $\int_{-\infty}^{\infty} \frac{\sin 4\alpha}{4\alpha} \cdot d\alpha$

(c) Evaluate the convolution:

$$\cos(2\pi 10t) * \delta(t-0.025) = \int_{-\infty}^{\infty} \cos(2\pi 10\alpha) \cdot \delta(t-\alpha-0.025) \cdot d\alpha$$

2. (12 %) Given two signals $x(t) = 10\sin c^2 200t$ and $y(t) = 5\cos(2\pi 100t)\sin(2\pi 1000t)$,

(a) Determine and sketch their Fourier transforms $X(f)$ and $Y(f)$, respectively.

(b) Determine the Nyquist sampling rate for the two signals $x(t)$ and $y(t)$, respectively.

3. (12 %) Suppose that the message signal $m(t)$ is given as $m(t) = 4\sin(2\pi 500t)$. The message signal is applied to the input of the system $H(f)$ shown in Fig. 2(a) and Fig. 2(b), where $c(t) = 10\cos(2\pi 4000t)$.

(a) Determine the output $y(t)$.
(b) What type of modulation is used for this scheme?

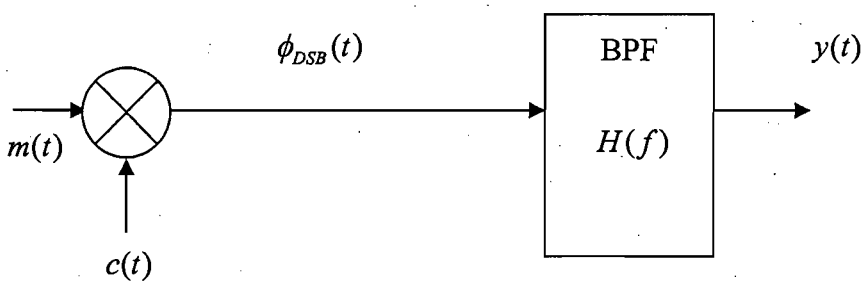

Fig. 2(a)

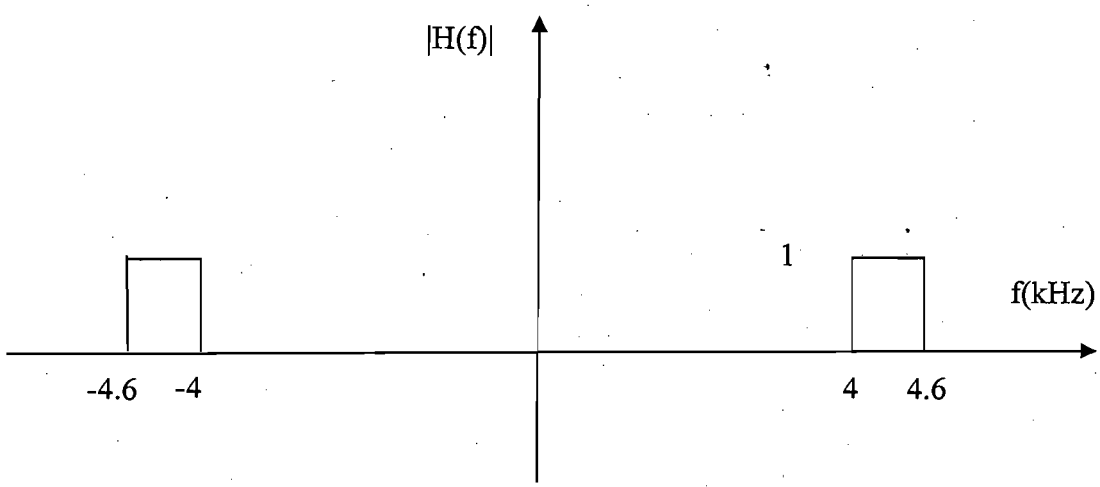

Fig. 2(b)

4. (12 %) A data sequence consisting of binary 1s and 0s transmitted with equal probabilities is transmitted using a line code with the pulse $p(t)$, $0 \le t \le T$ shown in Fig. 3. In this signaling, three amplitude levels are used in the following way: positive and negative pulses with the same amplitudes are used alternatively for symbol '0', and no pulse is always used for symbol '1'.

   (a) Assume a data sequence 10101100 is transmitted, sketch the output waveform.
   (b) Calculate the PSD for the line code.

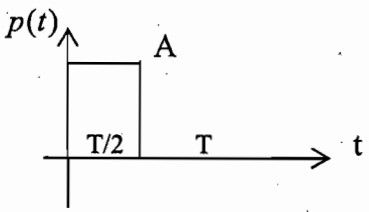

Fig. 3

5. (10 %) A 40G handy drive is used to store PCM data. Suppose that a video signal of the bandwidth 20 kHz is sampled at 8 times the Nyquist rate and the encoded PCM is to have at least 250 levels for encoding.

   (a) Sketch a block diagram of the PCM system doing the function.

   (b) How many hours of the signal can be stored on the handy drive?

6. (12 %)

   (a) Illustrate by a block diagram the approach to generate a wideband FM signal

   (b) Illustrate by a block diagram the way to generate a delta-modulation (Δ-modulation) signal.

   (c) Assume that an unmodulated FM signal $\Phi_{FM}(t) = 5\cos(2\pi 1000t)$ is corrupted by an interfering signal $\Phi_i(t) = 0.2\cos(2\pi 800t)$. The received signal $r(t)$ can be written as $r(t) = \Phi_{FM}(t) + \Phi_i(t)$. Using the phasor expression to demonstrate the received signal $r(t)$ and determine the phase $\psi(t)$ of the received signal $r(t)$.

7. (12 %) A pulse signal $p(t)$ was received at the input of a matched filter as shown in Fig. 4.
   (a) Determine the impulse response $h(t)$ of the matched filter.
   (b) Determine the output signal $p_o(t)$ of the matched filter.
   (c) Determine the sampled value $p_o(T)$ of the output signal at the time T.

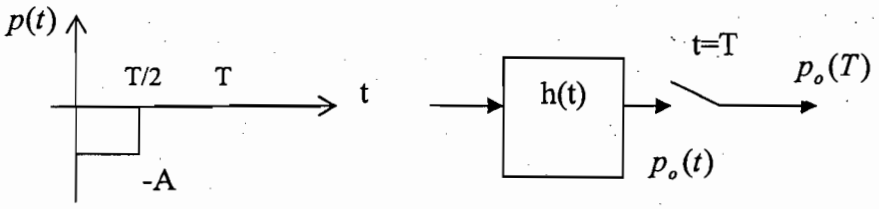

Fig. 4

8. (15 %) Binary data is transmitted by using the pulse $s_1(t)$, $0 \le t \le T$ for '1' and the pulse $s_2(t)$, $0 \le t \le T$ for '0', where $T = 2$ is the symbol duration. For an AWGN channel with the power spectral density $S_n(f) = N_0/2$, the received signals at the receiving end (Fig. 5) is expressed as $r(t) = s_i(t) + n(t)$, $0 \le t \le T, i = 1, 2$, Assume that the two signals are transmitted equally likely.
   (a) Determine the optimum threshold value V_{th} for the detector.
   (b) Determine the error probability of the receiver.
   (c) Is the receiver the optimum receiver? Explain your reason.

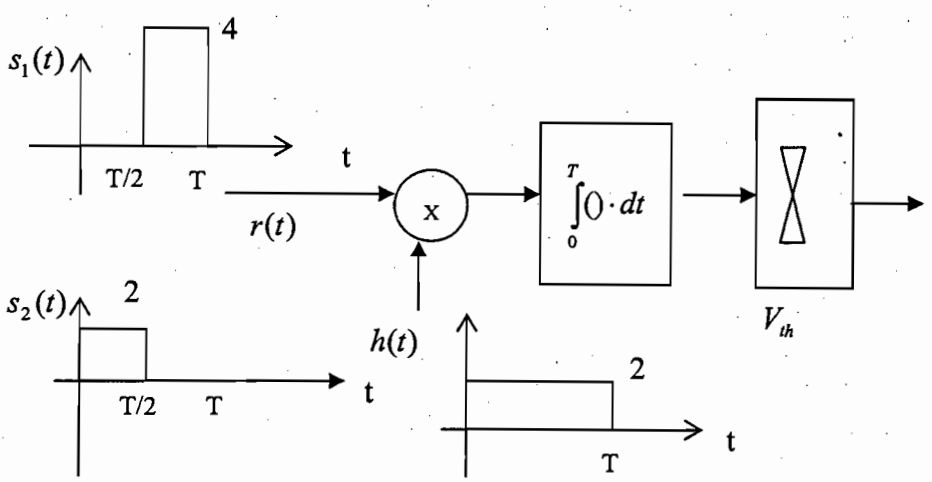

Fig. 5