國立高雄第一科技大學 97 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：2112　　考　科：通訊原理

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) (12 %) Find the Fourier transform for each of the following signals.

(a) $x(t) = \dfrac{10}{4\pi^2 t^2 + 4}$

(b) $x(t) = u(t+11) - u(t+9) + u(t-9) - u(t-11)$

(2) (15 %) An AM signal is expressed by $\Phi_{AM}(t) = 10[1 + k_a m(t)]\cos(2\pi 10^4 t)$, where $k_a = 0.25$ is the amplitude sensitivity of the modulator and $m(t) = 2\sin(2\pi 200t)$ is the message signal.

(a) Determine the transmission bandwidth of the signal.

(b) Determine the modulation index μ of the signal.

(c) Compute the average sideband power P_{sb}.

(d) Compute the average transmitted power P_T.

(e) Compute the power efficiency $\eta \equiv P_{sb} / P_T$.

(3) (15 %) The signal $m(t) = 5\sin(1625\pi t)$ frequency modulates the carrier $c(t) = 10\cos(2\pi 10^5 t)$. In the modulated signal, the frequency sensitivity f_d is given as $f_d = 975$ Hz/V.

(a) Determine the value of the modulation index β.

(b) What is the maximum frequency deviation of the modulated signal?

(c) Estimate the bandwidth by using the Carson's rule.

(d) Compute the power ratio in the bandwidth from the carson's rule.

(e) Estimate the bandwidth such that the power ratio is $P_r \geq 0.95$ (See table 1, Page 4)

(4) (12 %)

(a) What is the narrow band FM (NBFM)? Sketch the scheme to generate a NBFM signal.

(b) For binary FSK signals $s_i(t) = A\cos[2\pi(f_c \pm \Delta f)t + \phi]$ with $\Delta f = 1/T$, where ϕ is an unknown phase uniformly distributed over $(0,2\pi)$ for $0 \le t \le T$. Sketch the optimum noncoherent detection scheme.

(5) (12 %) A random binary data sequence consisting of binary 1s and 0s transmitted with equal probabilities is transmitted using a polar NRZ signaling with the pulse $g(t)$ shown in Fig. 1.

(a) Assume a data sequence 10100100 is transmitted, sketch the output waveform.

(b) Calculate the PSD for the line code.

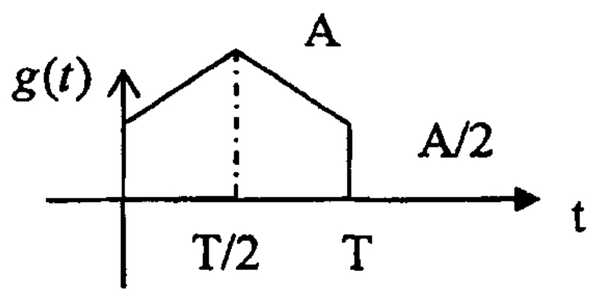

Fig. 1

(6) (12 %) A pulse signal $p(t)$ was received at the input of a matched filter as shown in Fig. 2.

(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.

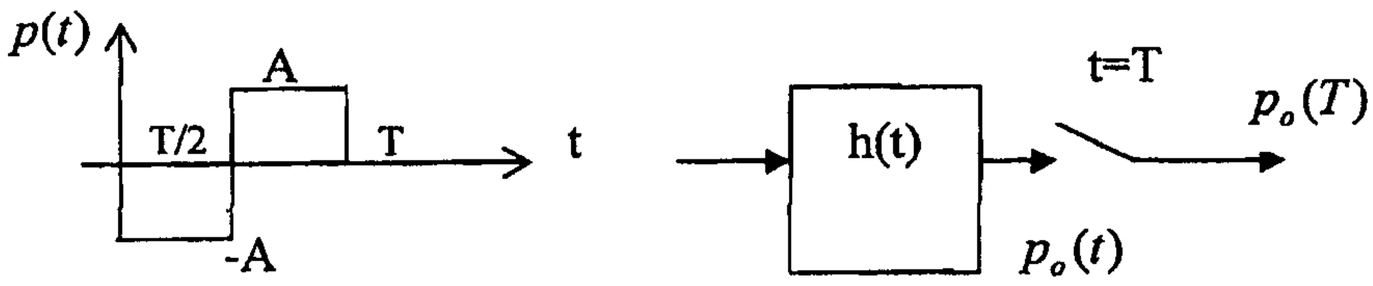

Fig. 2

(7) (14 %) 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 is the symbol duration. For an AWGN channel with the power spectral density $S_n(f) = N_0/2$, the received signals at the receiver end (Fig. 3) can be 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 (5%)

(b) Determine the error probability of the receiver. (5%)

(c) Is the receiver the optimum receiver? Explain your reason. (4%)

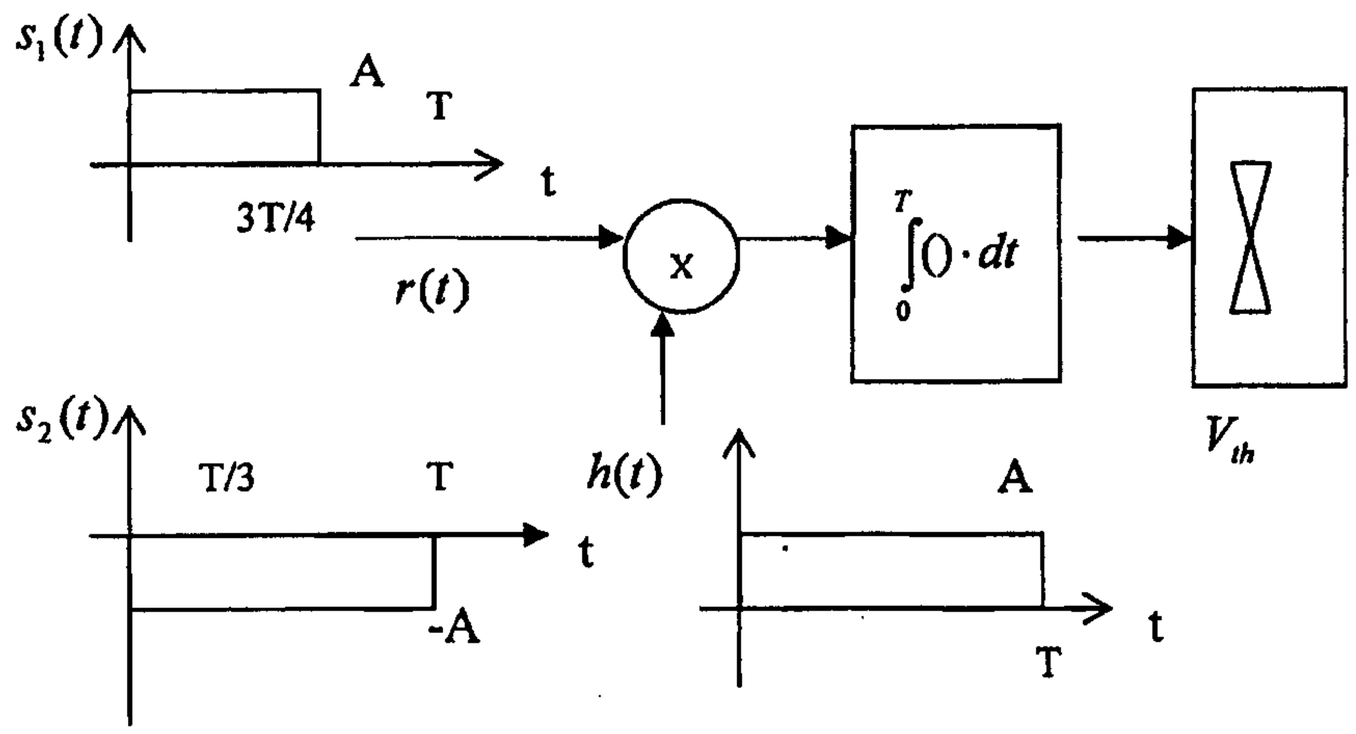

Fig. 3

(8) (8 %) PCM is a digital transmission system with an analog-to-digital converter at the input and a digital-to-analog converter at the output. Sketch the diagram of the functional blocks of a PCM generation system.

Table 1

Table A4.1 Table of Bessel Functions[a]

	$J_n(x)$								
n \ x	0.5	1	2	3	4	6	8	10	12
0	0.9385	0.7652	0.2239	−0.2601	−0.3971	0.1506	0.1717	−0.2459	0.0477
1	0.2423	0.4401	0.5767	0.3391	−0.0660	−0.2767	0.2346	0.0435	−0.2234
2	0.0306	0.1149	0.3528	0.4861	0.3641	−0.2429	−0.1130	0.2546	−0.0849
3	0.0026	0.0196	0.1289	0.3091	0.4302	0.1148	−0.2911	0.0584	0.1951
4	0.0002	0.0025	0.0340	0.1320	0.2811	0.3576	−0.1054	−0.2196	0.1825
5	—	0.0002	0.0070	0.0430	0.1321	0.3621	0.1858	−0.2341	−0.0735
6		—	0.0012	0.0114	0.0491	0.2458	0.3376	−0.0145	−0.2437
7			0.0002	0.0025	0.0152	0.1296	0.3206	0.2167	−0.1703
8			—	0.0005	0.0040	0.0565	0.2235	0.3179	0.0451
9				0.0001	0.0009	0.0212	0.1263	0.2919	0.2304
10				—	0.0002	0.0070	0.0608	0.2075	0.3005
11					—	0.0020	0.0256	0.1231	0.2704
12						0.0005	0.0096	0.0634	0.1953
13						0.0001	0.0033	0.0290	0.1201
14						—	0.0010	0.0120	0.0650

[a]For more extensive tables of Bessel functions, see Watson (1966, pp. 666–697), and Abramowitz and Stegun (1965, pp. 358–406).