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淡江大學八十九學年度碩士班招生考試試題

系別：電機工程學系　　科目：通 信 系 統

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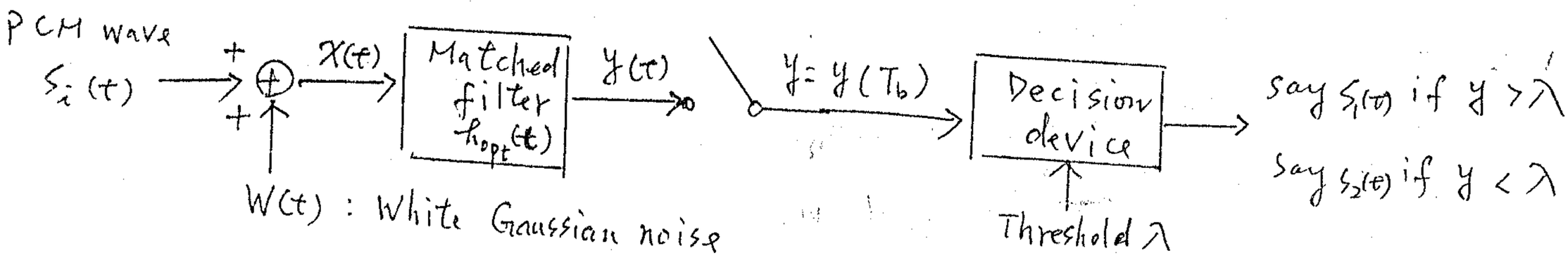
本試題雙面印製

一、(15%) The signal

$$m(t) = 6\sin(2\pi t) \text{ volts}$$

is transmitted using a 4-bit binary PCM system. The quantizer is of the uniform type, with a step-size of 1 volt. Sketch the resulting PCM wave for one complete cycle of the input. Assume a sampling rate of four samples per second, with samples taken at $t = \pm\frac{1}{8}, \pm\frac{3}{8}, \pm\frac{5}{8}, \ldots$, seconds.

二、(25%)

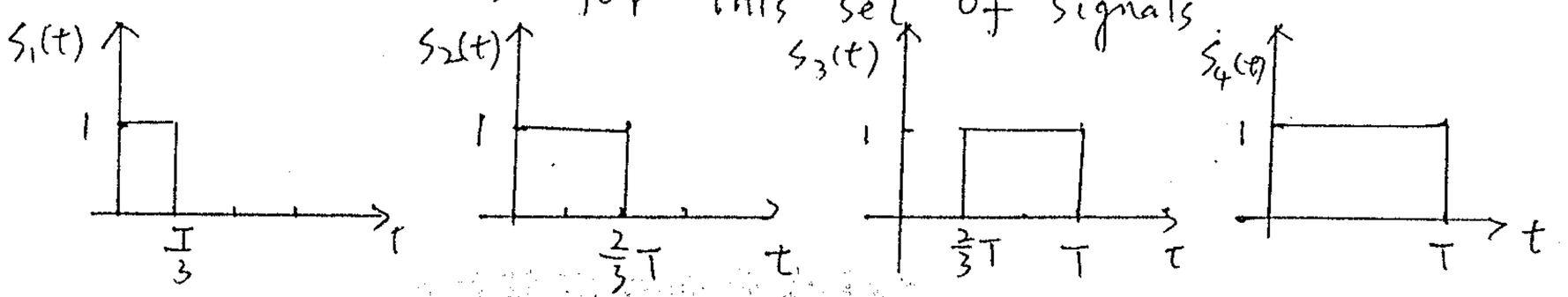


設 $s_1(t) = \begin{cases} A & \text{if } 0 \le t \le T_b \\ 0 & \text{o.w.} \end{cases}$, $s_2(t) = \begin{cases} -A & \text{if } 0 \le t \le T_b \\ 0 & \text{o.w.} \end{cases}$

$S_W(f) = \frac{N_0}{2}$, $N = n(T_b) = W(t) * h_{opt}(t)\big|_{t=T_b}$ is a Gaussian random variable $\sim N(0, \sigma^2)$ where $\sigma^2 = \frac{N_0}{2}\int_{-\infty}^{\infty} |H_{opt}(f)|^2 df$.

1. (8%) $h_{opt}(t) = ?$
2. (8%) $s_{oi}(T_b) = s_i(t) * h_{opt}(t)\big|_{t=T_b} = ?$ for $i = 1, 2$
3. (2%) $\lambda = ?$ such that P_e ($\triangleq$ the probability of error) for this receiver can be minimized.
4. (7%) $P_e = ?$

三、(20%) Consider the signals $s_1(t)$, $s_2(t)$, $s_3(t)$ and $s_4(t)$. Please use the Gram-Schmidt orthogonalization procedure to find an orthonormal basis for this set of signals



◀注意背面尚有試題▶

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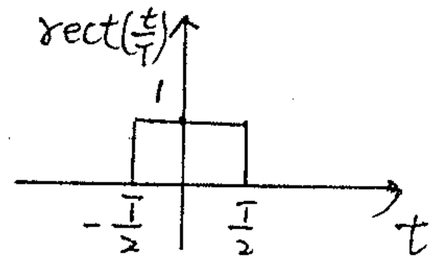
四(20%)　$g(t) = A\,\mathrm{rect}\left(\frac{t}{T}\right)\cos(2\pi f_c t)$



1.(5%)　$G(f)$=?

2.(5%)　$g_+(t)$ ≙ the pre-envelope of $g(t)$ = ?

3.(5%)　$\tilde{g}(t)$ ≙ the complex envelope of $g(t)$ = ?

4.(5%)　$a(t)$ ≙ the natural envelope of $g(t)$ = ?

五、(20%)　The FM signal

$$s(t) = A_c \cos\left(2\pi f_c t + 2\pi k_f \int_0^t m(\tau)\,d\tau\right)$$

is applied to the system consisting of a high-pass RC filter and an envelope detector. Assume that (a) the resistance R is small compared with the reactance of the capacitor C for all significant frequency components of $s(t)$ and (b) the envelope detector does not load the filter. Determine the resulting signal at the envelope detector output, assuming that $k_f|m(t)| < f_c$ for all t.