

# 國立臺北科技大學

101 學年第二學期電機系博士班資格考試

## 數位通訊理論 試題

第一頁 共二頁

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### 注意事項：

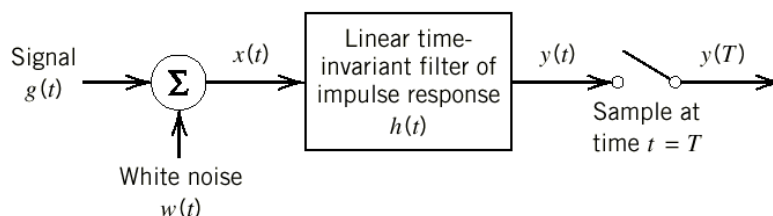
1. 本試題共【5】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間：二小時。

1. (20 %)

Let the random process  $X(t)$  be defined by  $X(t) = A + Bt$ , where  $A$  and  $B$  are independent random variables each uniformly distributed on  $[-1,1]$ . Find the mean and autocorrelation function of  $X(t)$ .

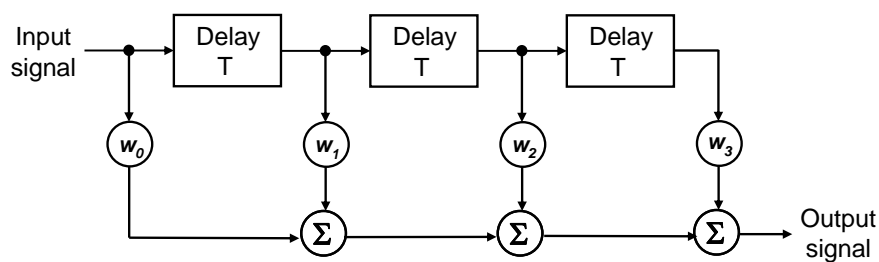
2. (20%)

Consider the baseband transmission system. Show that the impulse response of the optimum LTI filter is  $h_{opt}(t) = kg(T - t)$ .



3. (20%)

Consider a channel the output of which, in response to a signal,  $s(t)$ , is defined by  $x(t) = a_1s(t-t_1) + a_2s(t-t_2)$ . It is proposed to use a four-tap delay-line-filter 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  $t_2 > t_1$ .



4. (20%)

For a coherent BPSK system, the two signals are defined by  $s_1(t) = \cos(2\pi f_c t)$  and  $s_2(t) = \cos(2\pi f_c t + \frac{3\pi}{4})$ ,  $0 \leq t \leq T_b$ . In the presence of additive white Gaussian noise of zero mean and power spectral density  $\frac{N_0}{2}$ , calculate the average probability of error.

5. (20%)

Consider the (7,4) code with parity check matrix  $\mathbf{H} = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 & 1 \end{bmatrix}$

(a) Construct the syndrome table for all the single-error patterns.

(b) If (1101010) is received, find the decoded codeword by using the syndrome decoding.