國立臺北科技大學

九十四學年度電腦與通訊研究所入學考試

通訊系統試題

填准考證號碼

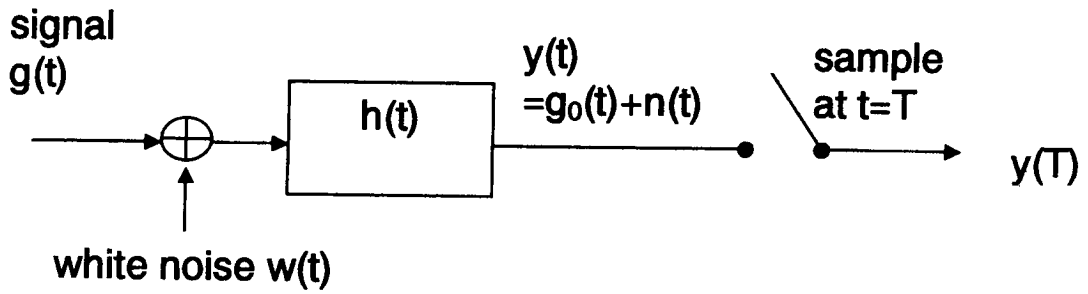
注意事項：

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. 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. (20%) Define (a) white random process (b) Gaussian random process

2. (20%) Consider a bandpass signal x(t) whose Fourier transform is given by
X(f)=(1+2j) δ (f-300000)+(5+6j) δ (f-320000)
+ (1-2j) δ (f+300000)+(5-6j) δ (f+320000),
where δ is the delta function.
(a) Compute the complex envelope $\tilde{x}(t)$ of x(t)
(b) Compute the Nyquist rates of $\tilde{x}(t)$ and x(t), respectively

3. (20%) Prove that the matched filter h(t)=kg(T-t) matched to the signal g(t), where k is an arbitrary constant, maximizes the peak pulse signal-to-noise ratio $\eta = \frac{|g_0(T)|^2}{E[n^2(t)]}$. Hint: Using Schwarz's inequality.



4. (20%) Assume s_i , i=1,2..., M, is the transmitted M-ary signal, n is the additive noise, r is the received signal and $r=s_i+n$. Define and compare (a) maximum a posteriori probability (MAP) rule for coherent detection of signals in additive noise and (b) maximum likelihood (ML) rule for coherent detection of signals in additive noise.

5. (20%) Assume coherent detection, every symbol has the same energy E and the same interval T, the carrier frequency is f_c, and the additive white Gaussian noise (AWGN) has two-sided power spectral density $N_0/2$.

(a)Draw the signal space diagram for coherent quadriphase-shift-keying (QPSK) system and define the QPSK transmitted signals $s_i(t)$, i=1,2,3,4.

(b) Compute the union bound on the symbol error probability for QPSK. The error probabilities must be expressed in terms of Q function, where

$$Q(x) = \frac{1}{\sqrt{2\pi}} \int_x^\infty exp(-\frac{v^2}{2}) dv$$