國立臺北科技大學九十五學年度研究所博士班招生考試

系所組別：1240 電機工程系丁(通訊)組

通訊原理 試題

填 准 考 證 號 碼

注意事項：

1. 本試題共六題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. The Generator Matrix "G" of Linear Block Coder is listed as below. Please Find the Parity-Check Matrix "H" and the Syndrome Look-up Table. (20%)

$$G=\begin{bmatrix}1&0&0&1&1&0&0&0\\0&1&1&0&0&1&0&0\\1&0&1&0&0&0&1&0\\0&1&0&1&0&0&0&1\end{bmatrix}$$

2. Please calculate the ratio of peak signal power to average quantization noise power, (S_p/N_q), with 8-bit linear PCM quantizer.(15%)

3. Determine whether or not $s_1(t)$ and $s_2(t)$ are orthogonal over the interval $(-1.5T_2 < t < 1.5T_2)$, where $s_1(t)=\cos(2\pi f_1 t+\phi_1)$, $s_2(t)=\cos(2\pi f_2 t+\phi_2)$, and $T_2=1/f_2$ for the following case: (15%)
   (a). $f_1=f_2$ and $\phi_1=\phi_2$
   (b). $f_1=\frac{1}{3}f_2$ and $\phi_1=\phi_2$
   (c). $f_1=2f_2$ and $\phi_1=\phi_2$
   (d). $f_1=\pi f_2$ and $\phi_1=\phi_2$
   (e). $f_1=f_2$ and $\phi_1=\phi_2+\pi/2$

4. A time-sequence function is defined as below:
$y[n]=2x[n]-3x[n-1]+4x[n-2]-2y[n-1]+3y[n-2]$
Please find the transfer function $H(z)$. Moreover, please draw the Direct-Form II structure of $H(z)$ and design a simple C-program for this IIR filter.(15%)

5. Consider a linear prediction filter, the filter output $\hat{x}[n]$ is defined as below:

$$\hat{x}[n]=\sum_{k=1}^{p} w_k x[n-k]$$

The p is the prediction order. The w_k is the predictive coefficient. The mean square value J of prediction error is defined as below:

$$J=E[(x[n]-\hat{x}[n])^2]$$

Please derive and prove the following equations.

$$w_O=R_x^{-1}r_x$$
$$J_{\min}=\sigma_x^2-r_x^T R_x^{-1}r_x$$

(The w_O is the optimum coefficient vector. The $J_{\min}$ is the minimum mean square value of the prediction error. The r_x is p-by-1 autocorrelation vector. The R_x is p-by-p autocorrelation matrix.) (20%)

6. Please use a brief introduction to describe 3G, WiMax, SIP, EI, and Skype. (15%)