

國立臺北科技大學

九十二學年度電機工程系碩士班入學考試

通訊原理試題

填准考證號碼

第一頁 共一頁

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注意事項：

1. 本試題共【八】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. Determine which of the following functions have the properties of autocorrelation functions. (15%)
 - (a) $R(\tau) = \delta(\tau) + \cos(2\pi\tau)$
 - (b) $R(\tau) = \sin^2(2\pi\tau) + \delta(\tau^2 - 10)$
 - (c) $R(\tau) = \exp(-2\pi|\tau - 10|)$
 - (d) $R(\tau) = \begin{cases} 1, & -1 \leq \tau \leq 1 \\ 0, & \text{otherwise} \end{cases}$
 - (e) $R(\tau) = 1 - |\tau|$, for $-1 \leq \tau \leq 1$
2. Let X and Y be statistically independent Gaussian-distributed random variables, each with zero mean and unit variance. Define the Gaussian process $Z(t)$:
$$Z(t) = X \cos(2\pi t) + Y \sin(2\pi t)$$
Is the process $Z(t)$ is WSS? Please prove it. (15%)
3. A complex system with impulse response $h(t) = \pi\delta(t) - j/t$. If the input signal $x(t) = A[1 + \cos^2(2\pi f_c t)]$ is filtered by the complex system. Please calculate the output signal $y(t)$. (15%)

4. Please draw: (10%)

- (a) The schematic diagram of "Multiplexer in transmitter of FM stereo".
- (b) The schematic diagram of "Demultiplexer in receiver of FM stereo".

5. A linear quantizer system with n-bit. Please calculate the maximal SNR(signal-to-quantization noise ratio) value in term of value "n". (10%)

6. If the linear prediction signal at time t is $\hat{x}(t)$ which is defined as below: (15%)

$$\hat{x}(t) = a_1x(t-1) + a_2x(t-2)$$

(a). Please find the predictive coefficients a_1, a_2 with the terms of auto-correlation function $R_x(\tau)$.

(b). If the signal $x(t)$ is defined as below:

$$x(t) = 5 \cos(2.5\pi t)$$

Please find the values of a_1, a_2 .

7. Consider the received signal $s(t) = A * \sin(\frac{4\pi t}{T})$, (10%)

(a) Determine the optimal match filter $h(t)$

(b) With the optimal match filter, please calculate the output value of optimal detector at $t=0.5T$, and $1.0T$.

8. Please draw: (10%)

- (a) The block diagram of "DPSK transmitter".
- (b) The block diagram of "DPSK receiver".