國立成功大學

110學年度碩士班招生考試試題

編　號：109

系　所：工程科學系

科　目：訊號與系統

日　期：0203

節　次：第 2 節

備　註：不可使用計算機

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (10%) Let

$$y(t) = x(t)x(-t+1)$$

where $x(t)$ is the input and $y(t)$ is the output. Is this system invertible? If not, find two input signals $x_1(t) \neq x_2(t)$ with the same output signals $y_1(t) = y_2(t)$.

2. (15%) For a real signal $x(t)$ and its Fourier transform $X(j\omega)$, show that the Fourier transform of $x_e(t)$ is $Re\{X(j\omega)\}$ where $x_e(t)$ is the even component of $x(t)$ and $Re\{X(j\omega)\}$ is the real part of $X(j\omega)$.

3. (15%) For two signals $x(t)$ and $y(t)$, we define

$$\phi_{xy}(t) = \int_{-\infty}^{\infty} x(t+\tau)y(\tau)d\tau.$$

Show that $\phi_{xy}(t) = \phi_{yx}(-t)$ and compute the odd component of $\phi_{xx}(t)$.

4. (20%) For $0 < a \leq 1$, find

$$x(t) = \text{sinc}(at) * \text{sinc}(t) = ?$$

Also find the Nyquist rate of $x(t)$.

5. (10%) Let $x(t) = u(t-s) - u(-t-s)$ where $u(t)$ is the unit step function and s is a positive integer. If the spectrum of $x(t)$ is $X(j\omega)$, find $X(j0)$.

6. (15%) For the time-domain signal

$$x(t) = \frac{\cos(t)}{t}$$

find the Fourier transform of $x(t)$.

7. (15%) Let

$$x(t) = \frac{2}{1+t^2}$$

Find the Fourier transform of $x(t)$.