國立臺北科技大學 105 學年度碩士班招生考試

系所組別：2141 電機工程系碩士班丁組

第二節　通訊原理　試題　（選考）

注意事項：

1. 本試題共 5 題，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。

一、(20%)

In a digital communication system, source coding, channel coding, modulation, channel estimation, symbol synchronization, frequency synchronization are some common building blocks to accomplish wireless communications. Please briefly answer the following questions:

1. What's the purpose of "source coding"? (5%)
2. What's the purpose of "channel coding"? (5%)
3. What's the purpose of "modulation"? (5%)
4. What's the purpose of "symbol synchronization"? (5%)

二、(20%)

Explain the following questions in details:

1. For AM modulation, why it requires twice the bandwidth of the message, and has power efficiency less than 50% in general? (10%)
2. For FM modulation, why mathematically it requires an infinity bandwidth? (10%)

三、(20%)

Consider the following signal:

$$x(t) = 40\text{sinc}(20t)$$

1. Derive the Fourier transform of $x(t)$. Show your details. (10%)
2. Computer the energy of $x(t)$. (10%)

四、(20%)

Consider a random process with the sample function

$$n(t) = A\cos(2\pi f_0 t + \theta),$$

where A, f_0 are constants and θ is a random variable with the probability density function

$$f_\theta(\theta) = \frac{1}{2\pi}, |\theta| \le \pi.$$

1. Compute the first moment statistical averages $E[n(t)]$. (5%)
2. Is the random process wide-sense stationary (WSS)? Explain in details. (5%)
3. Compute the power spectral density of $n(t)$. (10%)

五、(20%)

Assume that a DSB signal

$$x_c(t) = m(t)\cos(2\pi f_c t + \phi_0)$$

is demodulated using the demodulation carrier $2\cos(2\pi f_c t + \theta(t))$, where $m(t)$ is the message signal, f_c is the carrier frequency, and ϕ_0 is a constant phase.

1. Let $\theta(t) = \theta_0$, a constant. Determine the demodulated output $y(t)$. (5%)
2. Let $\theta(t) = 2\pi f_0 t$, where f_0 is a constant.
   (1) Determine the demodulated output $y(t)$. (5%)
   (2) Determine the mean-square error between $m(t)$ and the demodulated output $y(t)$. (10%)