

國立臺北科技大學九十九學年度碩士班招生考試

系所組別：2320 資訊工程系碩士班乙組

第二節 通訊概論 試題

第一頁 共一頁

注意事項：

1. 本試題共五題，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. (a) Figure 1 shows an ideal (original) data pulse transmitting through wired channels, given the impedance mismatch existed. Please plot the possible waveforms when the mismatch is too low and too high respectively that caused by the effect of impedance mismatch. (5%)



Figure 1 A data pulse.

- (b) Figure 2 shows ideal (original) data pulses transmitting through a finite bandwidth channel. Please plot the possible waveforms when the data pulses encounter a low-frequency attenuation and high-frequency distortion respectively that caused by the effect of channel bandwidth, and explain the answers you provided. (5%)



Figure 2 Data pulses.

- (c) What is the echo (or return loss)? In wired voice communications, what is the most serious form of echo arises from imperfect hybrid balance in telephones? (5%)
- (d) Compare three technologies: WLAN, ZigBee, and Bluetooth, at least from four different aspects such as coverage (communication distance), data rate, physical layer technology, and the corresponding standard. (5%)
- (e) Compare the promising 4G technologies: WiMAX and LTE. (5%)

2. (a) Define the dynamic range (DR) for a PCM system. For a multiple bit PCM system if the quantization level is 240, what is the DR and the signal-to-noise ratio (S/N) for the digitizing system in dB? (6%)
- (b) Design a Delta modulation system (including transmitter/modulator and receiver/demodulator), specify the input and output properly, and explain the operation in a detail. (10%)
- (c) In a bus topology, why does it need a terminator? What should be the value for the terminator in Ohms? (6%)
- (d) Is the ideal low pass filter a causal function? Why? Illustrate an approximation for it by giving the frequency response $H(f)$. (8%)
3. (a) What is the power spectral function of a non-wide-sense stationary process? Explain your answer. (5%)
- (b) Find the power spectral density $s(f)$ of BPNZ-AMI (Bipolar non-return-to-zero Alternate Mark Inversion) encoding. (5%)
- (c) Given the maximum bit rate of BPNZ-AMI is 10Mbps, what is the minimum bandwidth required for it? (5%)
4. (a) Define the Hilbert transform of $x(t)$ is $H\{x(t)\} \triangleq \hat{x}(t)$ and the frequency transform of $\hat{x}(t)$ is $F\{\hat{x}(t)\} \triangleq \hat{X}(f)$. Find $\hat{x}(t) * \left(\frac{-1}{\pi t}\right) = ?$ (note: "*" represents the convolution operator.) (5%)
- (b) Given a random process $x(t) = A \cdot \cos 2\pi f_o t - B \cdot \sin 2\pi f_o t$, where A and B are independent Gaussian random variables each with zero mean and variance σ^2 . Find σ_x^2 and $R_{xx}(\tau)$. (10%)
5. (a) Plot the block diagram of the Offset-keyed QPSK transmitter. (5%)
- (b) Assume the I and Q components of the OQPSK signal generated in your transmitter can be written as $x_i(t) = \sum_k a_{2k} p(t - 2kT_b)$ and $x_q(t) = \sum_k a_{2k+1} p(t - 2kT_b - T_b)$, where $a_k = (2A_k - 1)$ is the polar sequence corresponding to the message bit sequence A_k , and $p(t) = \Pi(t/T_b)$ for NRZ rectangular pulse shaping. Sketch $x_i(t)$ and $x_q(t)$ for the bit sequence 10100011. (5%)
- (c) What is the bandwidth required for the OQPSK signal? (5%)