

國立臺北科技大學九十八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【5】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。

一、Answer the following questions (be concise and precise):

1. What is the Near/Far Problem? How to compensate it (explain the methods of power control)? (5%)
2. Compare the differences and the similarities between multiple access and multiplexing. (5%)
3. Explain the term "multipath". Also, how does the spread spectrum technique can resolve the multipath components? (5%)
4. What is the purpose of a channel equalizer? What is the side effect that may caused by an equalizer? (5%)
5. What is purpose of the Gram-Schmidt orthogonalization process? (5%)

二、Calculate the following:

1. $\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} e^{-(t+\tau)} \mu(t+\tau) \delta(t-\tau) d\tau dt = ?$ (10%)

2. The autocorrelation function $R(\tau)$ of the Poisson increments is given by

$$R(\tau) = \begin{cases} a^2, & |\tau| > \varepsilon \\ a^2 + \frac{a}{\varepsilon} (1 - \frac{|\tau|}{\varepsilon}), & |\tau| < \varepsilon \end{cases}$$

Find the power spectrum density $S(\omega)$. (10%)

- 三、
1. If the T-1 carrier system is used for voice channel, the signaling bits form a stream to provides network control and routing information (called control signal) for each channel. What is the data rate of control signal for each channel? (10%)
 2. If a T-1 carrier system slips and loses track of where it is, it tries to resynchronize

using the first (framing) bit in each frame. Assuming the synchronization pattern to be 100011011100, this pattern repeats continuously and the receiving equipment locks onto it in order to properly synchronize with the incoming data. How many frames will have to be inspected on the average to resynchronize with a probability of 0.001 of being wrong? (10%)

四、Given the digital scrambler as shown in the Fig. 1, where D is a one-bit delay or a D flip flop.

1. Suppose a data sequence $S = 101010000000001$ is applied to the input of this scrambler. Derive the expression for T and determine the output sequence T (just find the first 15 bits of the sequence). (10%)
2. Design a digital descrambler and then show the process of recovering the data sequence S (at least show the first 15-bit of recovered sequence S). (10%)

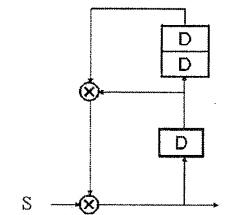


Fig. 1

五、1. What is the minimum-energy equivalent signal set of a binary ON-OFF signal set? (5%)

2. An orthogonal signal set is given by

$$S_k(t) = \sqrt{E} \phi_k(t), \quad k = 1, 2, \dots, N.$$

A biorthogonal signal set is formed from the orthogonal set by augmenting it with the negative of each signal. That is, we add to the orthogonal set another set

$$S_{-k}(t) = -\sqrt{E} \phi_k(t), \quad k = 1, 2, \dots, N.$$

This gives $2N$ signals in an N -dimensional space. Assuming all signals to be equiprobable and an AWGN channel, find the error probability of the optimum receiver. Also, how does the bandwidth of the biorthogonal set compare with that of the orthogonal set? (10%)