大葉大學 九十三 學年度 研究所博士班 招生考試試題紙					
系 所 別	組 別	考 試 科 目 (中文名稱)	考 試 日 期	節 次	備 註
電機工程學系	丙	電信工程	6月21日	第一節	共兩頁 p1

註：考生可否攜帶計算機或其他資料作答，請在備註欄註明（如未註明，一律不准攜帶）

（共六題，選答四題）

Electromagnetic theory (25pts each) Spring, 2004

** Please write down your computations in detail; no calculator is allowed.

1. (a) (8pts) Write down the differential form of Maxwell's equations for time-varying fields. (Do not forget the vector notations).
   (b) (8pts) Write down the integral form of Maxwell's equations for time-harmonic fields. (Do not forget the vector notations).
   (c) (9pts) Give physical interpretations for these equations.

2. (a) (9pts) Explain the reason (or prove) that a single-conductor waveguide cannot support a TEM wave.
   (b) (8pts) Please draw the field lines of a TM_{11} wave on the cross-section of a rectangular waveguide. Please add appropriate arrows on the field lines (Use solid lines for electric fields and dotted lines for magnetic fields; also, use the convention that denser field lines imply fields with higher strength).
   (c) (8pts) Perform the similar task for a TE_{11} wave.

3. (25pts) Find the power dissipated in the load, R_L, which is connected to a lossless two-section transmission line, as shown in Fig. A. ($V_S = 20\cos(2\pi f t)$ (V), $f = 1$ (GHz), $R_S = 20(\Omega)$, $R_L = 20(\Omega)$, $Z_{01} = 200(\Omega)$, $Z_{02} = 40(\Omega)$.)

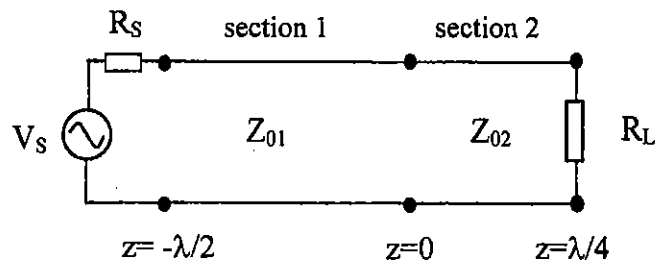

Fig. A

Communication theory (25pts each)

4. The duobinary signaling system block is shown in Fig. B, (5 pts each)
   (a). What's the duobinary coding scheme?
   (b). What's the output sequence $\{y_k\}$, if the binary digital sequence $\{x_k\} = \{0\ 0\ 1\ 0\ 1\ 1\ 0\}$, the first bit of the sequence to be considered as a startup bit, and the bipolar amplitude expressed as "0"="-1", "1"="+1".
   (c). It is known there exist the drawback of "error propagation" for duobinary signaling, and how to solve it?
   (d). Why can we say that the duo-binary signaling system has the equivalent transfer function to cosine filter?
   (e). Illustrating 3 key points for the results from the comparing binary to duobinary signaling.

5. It is well known that the acknowledgement of the statistical properties of the received signal envelope is necessary for the development of digital communication systems. Answer the following problems please.
   (a). Why are Rayleigh and Rice processes preferred for modeling fast-term fading, whereas slow-term is modeled with a lognormal process. (15 pts)
   (b). Determine the pdf (probability density function) of $R = \beta r^2$, where β is an arbitrary constant and r is a random variable characterized as the Nakagami distribution is given as

$f_R(r) = \frac{2m^m r^{2m-1}}{\Omega^m \Gamma(m)} \exp(-\frac{mr^2}{\Omega})$, where m is the fading figure, $\Omega = E[r^2]$ denotes the variance of r. (The Nakagami process is usually used to characterize the fading channel in urban environments) (10 pts)

6. The sample function $x(t)$ of a process $X(t)$ consisting of a random sequence of equal probability with binary symbols "1" and "0" is shown in Fig. C. Suppose that t_d is the sample value of a uniformly random variable T_d, with the pdf defined as

$$f_{T_d}(t_d) = \begin{cases} \frac{1}{T}, & 0 \le t_d \le T \\ 0, & \text{elsewhere} \end{cases}$$

(a). Determine the mean value of the process $X(t)$. (5 pts)

(b). Determine the autocorrelation function of random binary $x(t)$. (15 pts)

(c). Calculate the normalized average power of x(t)? (5 pts)

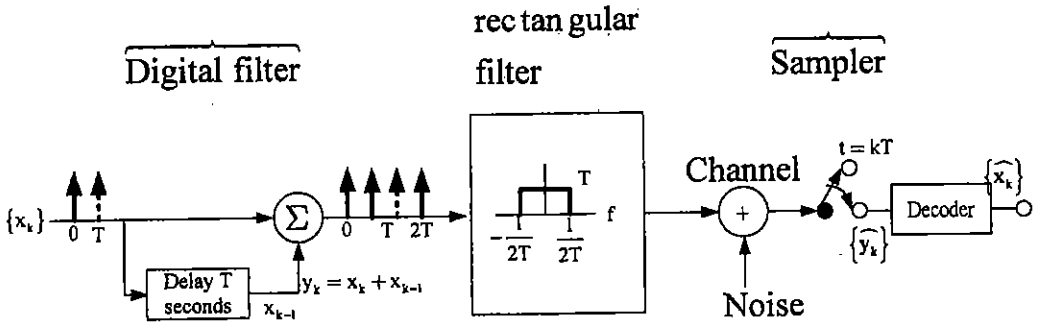

Fig. B Duobinary signaling

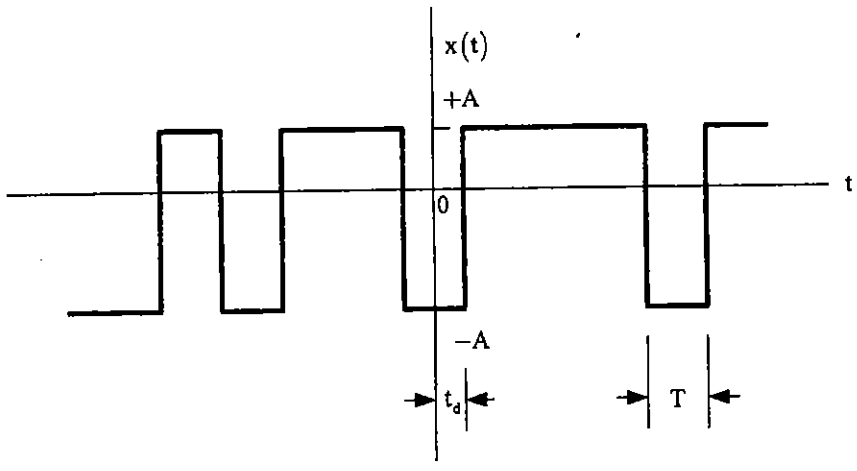

Fig. C Sample function of random binary wave