

科目：431 工程數學  
系組：電機系系統組

(本試題共 / 頁, 第 / 頁)

考生注意：1. 依次序作答，只要標明題號，不必抄題。  
2. 答案必須寫在答案卷上，否則不予計分。  
3. 試題隨卷繳回。

## Engineering Mathematics

June 19, 2004

1. (15%) The natural numbers are the possible values of a random variable  $X$ : that is,  $x_n = n$ ,  $n = 1, 2, \dots$ . These numbers occur with probabilities  $P(x_n) = (\frac{1}{2})^n$ . Find the expected value of  $X$ .
2. (20%) Find the mean value and variance of the random variable  $X$  having the uniform density function,

$$f_X(x) = \begin{cases} 1/(b-a) & a \leq x \leq b \\ 0 & \text{elsewhere} \end{cases}.$$

3. (15%) Find the value  $c$  in the following square matrix  $A$  such that  $A$  is *not* invertible.

$$A = \begin{bmatrix} 1 & 0 & -c \\ -1 & 3 & 1 \\ 0 & 2c & -4 \end{bmatrix}.$$

4. (20%) Find a complete solution of the following equation:

$$y'' + 5y' + 6y = 3e^{-2x} + e^{3x}.$$

5. (15%) If the Laplace transform of  $y(t)$  is the following:

$$\mathcal{L}\{y(t)\} = \frac{s}{(s+2)^2(s^2+2s+10)},$$

find the function  $y(t)$ .

6. (15%) Find the Fourier series of the following function:

$$f(t) = \begin{cases} 0 & \text{when } -2 < t < -1 \\ k & \text{when } -1 < t < 1 \\ 0 & \text{when } 1 < t < 2 \end{cases}, \quad T = 4.$$