國立彰化師範大學 99 學年度碩士班招生考試試題

系所：積體電路設計研究所　　科目：工程數學

☆☆請在答案紙上作答，無演算過程不計分☆☆　　

1. Given the matrix A = $\begin{bmatrix} 1 & 1 & -1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$

   (1) What is the rank of A? (10%)

   (2) Find the inverse of A. (15%)

2. Let *X* be the life length of a certain type of chip (in days). Assuming *X* to be a continuous random variable, we suppose that the probability density function *f* of *X* is given by

   $f(x) = \begin{cases} a \div x^3 & , \quad if \quad 1500 \le x \le 2500, \\ 0 & , \quad elsewhere. \end{cases}$ What is the constant *a*? (25%)

3. Inputting a signal $x(t) = 5\sin(t)$ to a linear system with an impulse response $h(t) = e^{-2t}$, answer the following questions.

   (1) Write the Laplace transform of $x(t)$, $X(s)$. (5%)

   (2) Write the Laplace transform of $h(t)$, $H(s)$. (5%)

   (3) Write the Laplace transform of the output signal $y(t)$, $Y(s)$. (5%)

   (4) Derive the output signal $y(t)$. (10%)

4. Solve the following linear differential equation, $y''-4y'+5=0$, where $y = x(t)$. (25%)