淡江大學 102 學年度碩士班招生考試試題

系別：機械與機電工程學系　　科目：工 程 數 學

考試日期：3 月 10 日(星期日) 第 2 節　　　　本試題共　4　大題，　1　頁

1. (25%) By the Laplace method, solve the following differential equation and find the steady state solution.

$$y'''(t) + 5y''(t) + 7y'(t) + 3y(t) = u(t)$$

where $y(0) = y'(0) = y''(0) = 0$, and $u(t) = 1$, for $t \geq 0$.

2. (25%) Solve the partial differential equation

$$\frac{\partial^2 y}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2} \quad \text{for} \quad 0 \leq x \leq 2, \ t > 0$$

$$y(0, t) = y(2, t) = 0 \quad \text{for} \quad t > 0$$

$$y(x, 0) = 2x, \ \frac{\partial y}{\partial t}(x, 0) = 0 \quad \text{for} \quad 0 \leq x \leq 2$$

3. (15%) (a) Determine the inverse of the following matrix A.

(15%) (b) Determine eigenvalues and eigenvalues of the following matrix A, where $\theta = \frac{\pi}{4}$.

$$A = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

4. (10%) (a) Solve $y'' + 4y' + 3y = 0$; $y(0) = 1$, $y'(0) = 2$.

(10%) (b) Solve $y'' + 4y' + 3y = 2e^{-2x}$; $y(0) = 1$, $y'(0) = 2$.