

淡江大學 106 學年度碩士班招生考試試題 15-1

系別：機械與機電工程學系

科目：工程數學

考試日期：3月4日(星期六) 第1節

本試題共 七 大題， 一 頁

1. (12%) Solve  $4xy + 2x + (2x^2 + 3y^2)y' = 0$ ,  $y(0) = 2$ .

2. (13%) Solve  $x^2y'' - 5xy' + 9y = 0$ ,  $y(1) = 1$ ,  $y'(1) = 0$ .

3. (15%) Solve  $y'' + 2y' - 3y = 8e^x - 9x$ .

4. (15%) Solve  $\begin{cases} x' + 3y' - y = 0 \\ x' + 2y = e^{-t} \end{cases}$ ,  $x(0) = y(0) = 0$  by Laplace transform.

5. (15%) Find an orthogonal matrix to diagonalize the matrix  $A$ ,

$$A = \begin{bmatrix} 1 & 0 & \sqrt{2} \\ 0 & 2 & 0 \\ \sqrt{2} & 0 & 0 \end{bmatrix}.$$

6. (10%) A force  $\vec{F}(x, y, z) = \vec{i} - y\vec{j} + xyz\vec{k}$  moves an object along the path

$$\begin{cases} x = t \\ y = -t^2 \\ z = t \end{cases}, \quad 0 \leq t \leq 1.$$

Calculate the work.

7. (20%) Solve P.D.E.:  $\frac{\partial^2 y}{\partial t^2} = 4\frac{\partial^2 y}{\partial x^2}$ ,  $x > 0$ ,  $t > 0$

B.C.:  $y(0, t) = 0$ ,  $t > 0$

I.C.:  $y(x, 0) = 0$ ,  $x > 0$

$$\frac{\partial y}{\partial t}(x, 0) = e^{-x}, \quad x > 0$$