

國立成功大學

112學年度碩士班招生考試試題

編 號： 50

系 所： 地球科學系

科 目： 應用數學

日 期： 0207

節 次： 第 4 節

備 註： 不可使用計算機

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

一、 Please find the general/particular solutions of the following Ordinary Differential Equations (ODEs) (40%):

1. $y' = 1 + y^2$ (5%)

2. $y' = \sec^2 y$ (5%)

3. $2xydx + x^2dy = 0$ (5%)

4. $y'' + y = 0$ (5%)

5. $x^2y'' + 1.5xy' - 0.5y = 0$ (5%)

6. $y'' + y = 0.001x^2$ (5%)

7. $y'' + 5y' + 4y = 10e^{-3x}$ (5%)

8. $y'' + y = \cos x - \sin x$ (5%)

二、 Please find the eigenvalues and eigenvectors of the following matrix(10%)

$$\begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$$

三、 Please find the inverse matrix of the following matrix (10%)

$$\begin{bmatrix} 1 & -1 & -2 \\ 3 & -1 & 1 \\ -1 & 3 & 4 \end{bmatrix}$$

四、 Please find the Fourier series of the following function (15%)

$$f(x) = x + \pi \text{ if } -\pi < x < \pi \text{ and } f(x + 2\pi) = f(x)$$

五、 Please find the Fourier series of the following function (10%)

$$f(x) = x^2 \text{ if } -1 < x < 1 \text{ and } f(x + 2) = f(x)$$

六、 Please find the general solutions of the one dimensional heat conduction equation (15%):

$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$$

with boundary condition of $u(0, t) = u(L, t) = 0$ for all $t \geq 0$
and initial condition of $u(x, 0) = f(x)$