

# 國立成功大學

## 112學年度碩士班招生考試試題

編 號：102

系 所：土木工程學系

科 目：工程數學

日 期：0206

節 次：第 3 節

備 註：可使用計算機

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

1. (15%) For the given matrix  $A = \begin{bmatrix} 1 & -1 & 1 \\ -1 & -1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ ,

- (a) Find the eigenvalues and corresponding eigenvectors of  $A$ . (10%)  
 (b) Find the inverse of  $A$ . (5%)

2. (20%) Solve the Poisson's equation

$$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = -2$$

$$T(0, y) = 0, T(\pi, y) = 1, y > 0$$

$$T(x, 0) = 0, 0 < x < \pi$$

3. (20%) Solve the boundary-value problem (BVP)

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}, 0 < x < 1, t > 0$$

$$u(0, t) = 0, u(1, t) = 0$$

$$u(x, 0) = 0, \left. \frac{\partial u}{\partial t} \right|_{t=0} = \sin \pi x + 2 \sin 3\pi x$$

4. (10%) Find the Fourier series expansion for the following function:

$$f(x) = \pi^4 - x^4, -\pi < x < \pi$$

5. (15%) Suppose the surface  $S$  is oriented upward and is defined by a portion of the plane  $2x + y + 2z = 6$  in the first octant. Verify the Stoke's theorem for the vector  $\mathbf{F} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ .

6. (20%) Solve the initial-value problem (IVP)

(a)  $y'' + 4y = 16 \cos 2x, y(0) = 0, y'(0) = 0$  (10%)

(b)  $y'' + 2y' + 10y = 17 \sin x - 37 \sin 3x, y(0) = 6.6, y'(0) = -2.2$  (10%)