

元智大學 102 學年度研究所 碩士班 招生試題卷

系(所)別： 通訊工程學系碩
士班

組別： 微波組

科目： 工程數學

用紙第 1 頁共 1 頁

●不可使用電子計算機

1. (Linear Algebra A: 15%, B: 15%)

A. Find the **eigenvalues** and **eigenvectors** of the matrix

$$A = \begin{bmatrix} 5 & -4 & 4 \\ 12 & -11 & 12 \\ 4 & -4 & 5 \end{bmatrix}$$

B. **Diagonalize** the matrix A , showing the detail of your work.

2. (Differential Equation 20%)

Solve the following non-homogeneous linear ordinary differential equation (ODE)

$$x^2 y'' - 5xy' + 8y = 2 \ln x$$

3. (Laplace Transforms 30%)

Solve the following initial value problems (IVP) by using the *convolution theorem* of the Laplace Transformation.

$$y'' + 3y' + 2y = \begin{cases} t & 1 < t < 2 \\ 0 & \text{otherwise} \end{cases}, \quad y(0) = 0, \quad y'(0) = 0$$

4. (Fourier Analysis 20%)

Find the **Fourier coefficients** of the periodic function $f(t)$ defined by

$$f(t) = \begin{cases} 0 & -3 < t < 0 \\ t & 0 < t < 3 \end{cases} \quad \text{period} = 2L = 6$$