

元智大學 107 學年度 轉學考 招生試題卷

系(所)別：電機工程學系學士班 組別：電機工程學系乙組3年級 科目：工程數學(含線性代數) 用紙第 / 頁共 / 頁

●不可使用電子計算機

1. ODEs and Initial Value Problems (IVP) [45%]

A. Solve the following ODE, $y'(e^{2y} - y)\cos x = e^y \sin 2x$, $y(0) = 0$ [20%]

B. Solve the following ODE, $y'' - 6y' + 9y = 6x^2 + 2 - 12e^{3x}$. [25%]

2. Linear Algebra [15%]

Find the **eigenvalues** and their corresponding **eigenvectors** of the following matrix

$$A = \begin{pmatrix} 6 & -1 \\ 5 & 4 \end{pmatrix}.$$

3. Fourier Analysis [40%]

A. Find the **Fourier series** of the following periodic function with period

$$p = 2\pi, f(x) = \begin{cases} 0, & -\pi < x < 0 \\ \pi - x, & 0 \leq x < \pi \end{cases} \quad [20\%]$$

B. Find the **Fourier transforms** of the function, $f(x) = e^{-ax}$, where $a > 0$. [20%]

Note that the **Fourier transform** is defined by

$$F(\omega) = \mathfrak{F}\{f(x)\} = \int_{-\infty}^{\infty} f(x)e^{-i\omega x} dx$$