

國立高雄大學 103 學年度研究所碩士班招生考試試題

科目：工程數學  
考試時間：100 分鐘

系所：應用物理學系  
本科原始成績：100 分

是否使用計算機：是

1. (10%) Solve the differential equation  $(y+1)y'' = (y')^2$ .

2. (10%) Solve the initial-value problem.

$$y'' - y = x + \sin x, \quad y(0) = 2, \quad y'(0) = 3$$

3. (15%) Find the eigenvalues and eigenvectors of the matrix.

$$\mathbf{A} = \begin{bmatrix} 2 & -1 & 0 \\ 5 & 2 & 4 \\ 0 & 1 & 2 \end{bmatrix}$$

4. (10%) Use the inverse of coefficient matrix to solve the system.

$$x_1 + 2x_2 + 2x_3 = 1$$

$$x_1 - 2x_2 + 2x_3 = -3$$

$$3x_1 - x_2 + 5x_3 = 7$$

5. (10%) Use the Laplace transform to solve the initial-value problem.

$$y'' - 4y' + 4y = t^3, \quad y(0) = 1, \quad y'(0) = 0$$

6. (10%) Find the Fourier series of the function.

$$f(x) = \begin{cases} x+1, & -1 < x < 0 \\ x-1, & 0 \leq x < 1 \end{cases}$$

7. (10%) Evaluate  $\oint_C \frac{e^{2z}}{z^4 + 2z^3 + 2z^2} dz$ , where the contour  $C$  is circle  $|z| = 4$ .

8. (10%) Find the length of the graph of  $r = 2 - 2\cos\theta$  from  $\theta = 0$  to  $\theta = 2\pi$ .

9. (15%) Evaluate the surface integral  $\iint_S (y^2 + 2yz) dS$ , where  $S$  is the first-octant

portion of the plane  $2x + y + 2z = 6$ .