

# 國立高雄師範大學 112 學年度碩士班招生考試試題

系所別：電機工程學系

科目：基礎工程數學

※注意：1.作答時請將試題題號及答案依序寫在答案卷上，於本試題上作答者，不予計分。

2.答案卷限用藍、黑色筆作答，以其他顏色作答之部分，該題不予計分。

計算題：需要寫出計算過程（100%）

1. Verify that  $y = e^{3x} \cos(2x)$  is the solution of equation  $y'' - 6y' + 13y = 0$ . (10%)

2. Solve the initial problem  $\frac{dy}{dx} = -\frac{x}{y}$ ,  $y(4) = -3$ . (10%)

3. Solve the initial problem  $\cos x(e^{2y} - y) \frac{dy}{dx} = e^y \sin 2x$ ,  $y(0) = 0$ . (10%)

4. Solve  $(e^{2y} - y \cos(xy))dx + (2xe^{2y} - x \cos(xy) + 2y)dy = 0$ . (10%)

5. Solve  $y'' + 4y' + 7y = 0$ . (10%)

6. Find  $x_1, x_2, x_3$ , such that  $x_1 \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix} + x_2 \begin{bmatrix} 2 \\ 5 \\ -1 \end{bmatrix} + x_3 \begin{bmatrix} 3 \\ 8 \\ 0 \end{bmatrix} = \begin{bmatrix} 14 \\ 36 \\ -4 \end{bmatrix}$ . (8%)

7. Let  $A$  be a 3x3 matrix. If  $A = \begin{bmatrix} -1 & 0 & 1 \\ 0 & 2 & 2 \\ 2 & 3 & 0 \end{bmatrix}$ ,

(1) Find  $\det(A)$ . (3%)

(2) Find  $A^{-1}$ . (9%)

8. Let  $L$  be the linear mapping on  $R^3$  defined by

$$L(x) = [x_1 + 2x_2 + 2x_3, 2x_1 + 5x_2 + x_3, x_1 + 4x_2 - 4x_3]^T,$$

$$\text{where } \mathbf{x} = [x_1, x_2, x_3]^T.$$

(1) Represent  $L$  in the form of  $L(x) = A\mathbf{x}$ . (5%)

(2) Determine the kernel and range of the mapping  $L$ . (7%)

(3) Is  $L$  a one-to-one mapping? Why? (3%)

(背面尚有試題)

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9. Given the basis  $\{ \bar{x}_1 = (0,1,1)^T, \bar{x}_2 = (1,0,2)^T, \bar{x}_3 = (0,4,-2)^T \}$  for  $R^3$ .

(1) Use the Gram-Schmidt process to obtain an orthonormal basis  $\{\bar{u}_1, \bar{u}_2, \bar{u}_3\}$ . (9%)

(2) If  $\bar{x} = (3,1,1)^T$ , write  $\bar{x}$  as a linear combination of  $\bar{u}_1, \bar{u}_2$ , and  $\bar{u}_3$ . (6%)