

淡江大學 107 學年度碩士班招生考試試題

14-1

系別：電機工程學系機器人工程碩士班 科目：工程數學

考試日期：3 月 11 日(星期日) 第 1 節

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1. (20%) Find all solutions of the matrix equation $\mathbf{Ax} = \mathbf{b}$, where

$$\mathbf{A} = \begin{bmatrix} 1 & 1 & 1 & 2 & 0 \\ 2 & 2 & 3 & 5 & 1 \\ 4 & 4 & 2 & 6 & 2 \end{bmatrix}, \quad \mathbf{b} = \begin{bmatrix} -1 \\ 1 \\ 2 \end{bmatrix}, \quad \mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix}.$$

2. (20%) Find the eigenvalues and the corresponding eigenvectors of the following matrix

$$\mathbf{A} = \begin{bmatrix} -2 & 2 & 3 \\ -2 & 3 & 2 \\ -4 & 2 & 5 \end{bmatrix}.$$

3. (20%) Find the orthonormal basis of the column space of the following matrix

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

4. (20%) Find the solution of the following initial value problem.

$$y'' + y' - 2y = 2x, \quad y(0) = 0, \quad y'(0) = 1.$$

5. (10%) (a) Find the Laplace transform of $f(t) = e^{2t} + \sin(5t)$.

(10%) (b) Find the inverse Laplace transform of $F(s) = \frac{1}{s+1} + \frac{1}{(s+2)^2} e^{-s}$.