

淡江大學 105 學年度碩士班招生考試試題

29-1

系別：電機工程學系控制晶片與系統組
 機器人工程碩士班

科目：工程數學(含線性代數、常微分方程)

考試日期：3月5日(星期六) 第2節

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1. Determine the nullspace of the following matrix $\mathbf{A} = \begin{bmatrix} 2 & 1 & 1 & 1 \\ 1 & 1 & 1 & 2 \end{bmatrix}$. (10%)

2. Let $\mathbf{A} = \begin{bmatrix} 1 & 2 & -3 & 1 \\ -1 & -1 & 4 & -1 \\ -2 & -4 & 7 & -1 \end{bmatrix}$, $\mathbf{b} = \begin{bmatrix} 1 \\ 6 \\ 1 \end{bmatrix}$, $\mathbf{X} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}$. Find all solutions of the problem $\mathbf{AX} = \mathbf{b}$. (10%)

3. Let $\mathbf{A} = \begin{bmatrix} 1 & 1 \\ 1 & 2 \\ 2 & 1 \end{bmatrix}$, $\mathbf{b} = \begin{bmatrix} 11 \\ 22 \\ 33 \end{bmatrix}$, $\mathbf{X} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$. Find the least-squares solution of the problem $\mathbf{AX} = \mathbf{b}$. (20%)

4. Find the eigenvalues and the corresponding eigenvectors of the matrix $\mathbf{A} = \begin{bmatrix} 3 & 2 \\ 3 & -2 \end{bmatrix}$. (20%)

5. Consider the circuit shown in Fig. 1. Let $\mathbf{X} = [i_1 \ i_2 \ i_3]^T$ denote a 3-by-1 state vector. Determine a 3-by-3 matrix \mathbf{A} and a 3-by-1 vector \mathbf{b} to formulate the circuit using a linear system $\mathbf{AX} = \mathbf{b}$, and use Gauss-Jordan reduction to solve this system. (20%)

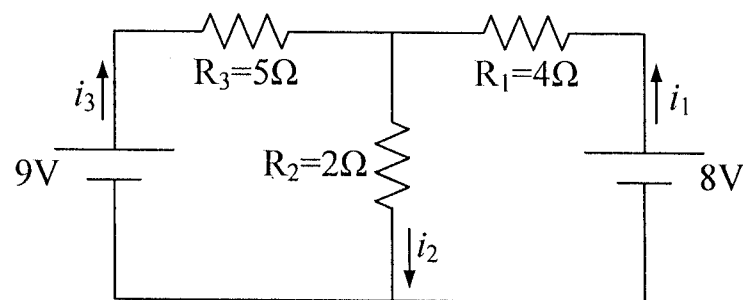


Fig. 1

6. In Fig. 2, the capacitor is initially discharged. Find the capacitor voltage $V_C(t)$ if the switch closes at $t=0$. (20%)

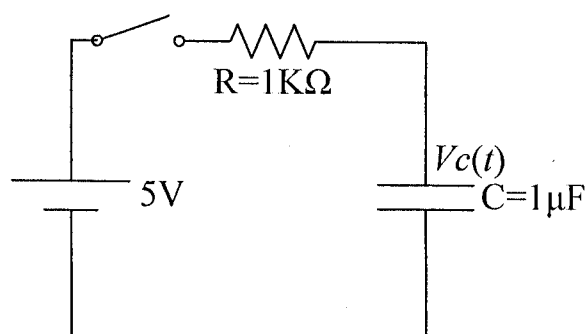


Fig. 2