

國立臺灣師範大學 100 學年度碩士班招生考試試題

科目：工程數學(電機電子組)

適用系所：工業教育學系

注意：1.本試題共 2 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則不予計分。

1. Given that the determinant $\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} = 4$, find the determinant

$$\begin{vmatrix} a_{11} - 2a_{31} & a_{12} - 2a_{32} & a_{13} - 2a_{33} \\ a_{21} & a_{22} & a_{23} \\ -4a_{31} & -4a_{32} & -4a_{33} \end{vmatrix}. \text{ (10 分)}$$

2. Find the eigenvalues of A^{10} for $\mathbf{A} = \begin{bmatrix} 1 & 5 & 7 & 9 \\ 0 & 2 & 6 & 16 \\ 0 & 0 & 0 & 2 \\ 0 & 0 & 0 & 4 \end{bmatrix}$. (10 分)

3. Find a matrix P that diagonalizes $A = \begin{bmatrix} 5 & 2 & 2 \\ 2 & 5 & 2 \\ 2 & 2 & 5 \end{bmatrix}$, and determine $P^{-1}AP$.

(15 分)

4. Suppose that matrices A and B are inverses of matrix C . Is it true that $A = B$? Justify your answer. (15 分)

5. Solve the differential equation $\frac{y^2}{2x} = \frac{xdy - ydx}{xdx + ydy}$. (10 分)

6. Find the inverse Laplace transform of the function $F(s) = \frac{3s^{-1} + 2.5s^{-2}}{13s^{-2} + 4s^{-1} + 1}$. (10 分)

7. Solve the differential equation $y'' + y = 13 \tan x$. (10 分)

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8. Please find the Laplace transform $L[f(t)]$ where $f(t) = 2$ on the interval $[a, b]$ (where $0 < a < b$) and $f(t) = 0$ otherwise. (10 分)

9. Find the general solution of the system (10 分)

$$\begin{cases} \frac{dx}{dt} = -8x - 11y - 2z \\ \frac{dy}{dt} = 6x + 9y + 2z \\ \frac{dz}{dt} = -6x - 6y + z \end{cases}$$