

國立臺灣科技大學

九十一學年度碩士班招生考試試題

系所組別：工程技術研究所自動化及控制學程甲組、丙組

科目：工程數學

總分為100分，題號請標示清楚。

1. Solve the following differential equation.(20%)

$$y'' - 2y' - 3y = 2\sin^2 x$$

2. Solve the following equations. (20%)

$$y' + 2y + 6 \int_0^t z dt = -2u(t)$$

$$z' + y' + z = 0$$

where $u(t) = \begin{cases} 0, & t < 0 \\ 1, & t \geq 0 \end{cases}$, and $y(0) = -5$, $z(0) = 6$

3. State the advantages of the power solution for a differential equation and use the Maclaurin series to solve the general solution including the recurrence relation. (20%)

$$y' - x^3 y = 4$$

4.

- (1) Describe the meaning of linear independence of vectors $F_1, F_2, \dots, F_k$ in R^n . (10%)
 (2) Evaluate the linear dependence of vectors $3i+6j-k, 8i+2j-4k, i-j+k$ in R^3 . (10%)

5. Consider a matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 0 \end{bmatrix}$

- (1) Find the eigenvalues. (6%)
 (2) Find the eigenvectors and state the physical meaning. (8%)
 (3) Calculate $A^4 - A^3 - 4A^2 - A$. (6%)

