

國立臺灣科技大學 111 學年度碩士班招生試題

系所組別：自動化及控制研究所碩士班

科目：工程數學

(總分為 100 分；所有試題務必於答案卷內頁依序作答，否則不予計分)



1. Solve the following ordinary differential equations: (20%)

(1) $y' + y/x = 3x^2y^3$ (10%)

(2) $y'' - 3y' = 2e^{2x}\sin(x)$; $y(0)=1, y'(0)=2$ (10%)

2. Use Laplace transform to solve $x(t), y(t), z(t)$ from the initial value problems .

$$x' - 2y' + 3z = 0$$

$$x - 4y' + 3z' = t$$

$$x - 2y' + 3z' = -1$$

With $x(0)=0, y(0)=0, z(0)=0$ (15%)

3. Find the exact solution of the initial value problem. Use the Euler method to obtain the approximate values of $y(x)$ with $h = 0.2$ and $n = 5$. and compare the approximate results with the exact solution.

$y' - y/x = 2x^2$; $y(1)=4$ (15%)

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4. Use the matrix exponential to solve the initial value problem $Y' = AY$ and $Y(0) = Y_0$,

where $A = \begin{pmatrix} 3 & 4 \\ 3 & 2 \end{pmatrix}$ and $Y_0 = \begin{pmatrix} 6 \\ 1 \end{pmatrix}$. (20%)

5. Let $f(x) = x^2$ for $-3 \leq x \leq 3$. Find the Fourier series for f on $[-3, 3]$. (15%)

6. Suppose two dice are rolled. If o is an outcome, let $X(o)$ equal the sum of the numbers on the dice. Determine the probability distribution of X , as well as the mean and standard deviation of X . (15%)

