

國立臺灣科技大學  
113學年度碩士班招生  
試題

系所組別：1200自動化及控制研究所碩士班

科 目：工程數學

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## 國立臺灣科技大學 113 學年度碩士班招生試題

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( 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. (8%) Solve the first-order ordinary differential equation.

$$y' = xy^2 - xy$$

2. (12%) Solve the following ordinary differential equation with initial values.

$$x^2y'' - 5xy' + 10y = 0 ; y(1) = 4, y'(1) = -6$$

3. (15%) Use Laplace transform to solve  $x(t)$ ,  $y(t)$  from the initial value problems.

$$3x' - y = 2t$$

$$x' + y' - y = 0$$

$$\text{With } x(0)=0, y(0)=0$$

4. (15%) Find the recurrence relation and use it to generate the first five terms of a power series solution about 0.

$$y' + (1 - x^2)y = x$$



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5. (20%) Solve Laplace's equation as  $\frac{\partial^2 u(x,y)}{\partial x^2} + \frac{\partial^2 u(x,y)}{\partial y^2} = 0$  with the boundary conditions  $u(0,y) = u(a,0) = u(x,0) = 0$  and  $u(x,b) = f(x)$ .

6. (10%) Diagonalize the matrix  $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ .

7. (10%) Find the Fourier series of the function  $f(t) = \begin{cases} 1 & 0 \leq t < h \\ 0 & h \leq t < 2\pi \end{cases}$ ,  
 $f(t+2\pi) = f(t)$ .

8. (10%) Find the Fourier transform of  $f(x) = \begin{cases} 2 & |x| < a \\ 0 & |x| \geq a \end{cases}$ .

