

國立臺灣科技大學

八十八學年度碩士班招生考試試題

系所別：工程技術研究所碩士班
自動化及控制學程

組別：甲、丙組

科目：工程數學

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

(1) $y' + y = \sin(x)$

(2) $y'' - 4y' + 4y = e^{3x} - 1$

2. Solve the following equation by Laplace Transform method, and state the advantage of this method. (20%)

$$y' + 3y + 2 \int_0^t y dt = 2u(t-1)$$

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

3. Expand the function $f(x)$ in a Fourier series (10%)

$$f(x) = x^2, \quad 0 \leq x \leq 2\pi \text{ and } f(x+2\pi) = f(x)$$

4. State the Green's theorem and evaluate the line integral

$$\oint_C (xy^4 dx + 2x^2 y^3 dy) \text{ counterclockwise around the contour } C: x^2 + y^2 = 1 \quad (10\%)$$

5. Solve the following equations :

$$x_1' - x_1 - x_3 = 0$$

$$x_2' - x_2 - x_3 = 0 \quad \text{or } X' = AX$$

$$x_3' - 2x_2 - x_3 = 0$$

by calculating the eigenvalues and the corresponding eigenvectors.

where $X(t) = [x_1(t) \ x_2(t) \ x_3(t)]^T$ (20%)

6. Solve the partial differential equation

$$2u_x - 3u_y + 2u = 2x$$

, where the initial condition $u(x,y) = x^2$ for the line $2y+x=0$. (20%)