

國立臺灣科技大學
八十七學年度碩士班招生考試試題

所 別：工程技術研究所

組 別：自動化工程組、控制組

科目：工程數學

學程別：自動化及控制學程

1. Solve

$$2\frac{dx}{dt} + \frac{dy}{dt} - y = t$$

$$\frac{dx}{dt} + \frac{dy}{dt} = t^2$$

subject to $x(0) = 1, y(0) = 0$. (15%)

2. Solve

$$\frac{dx}{dt} = -4x + y + z$$

$$\frac{dy}{dt} = x + 5y - z$$

$$\frac{dz}{dt} = y - 3z$$

(15%)

3. Use polar coordinates to evaluate

$$\int_0^1 \int_x^{\sqrt{8-x^2}} \frac{1}{5+x^2+y^2} dy dx$$

(10%)

4. Find the Fourier series of the following function which is assumed to have the period 2π .

$$f(x) = \frac{x^2}{4} \quad (-\pi < x < \pi) \quad (10\%)$$

5. Prove that if $f(t)$, defined for all positive t , is a periodic function with period T , that is, $f(t+nT) = f(t)$ for all integers n , then

$$\mathcal{L}\{f(t)\} = \frac{1}{1-e^{-sT}} \int_0^T e^{-st} f(t) dt \quad (10\%)$$

國立臺灣科技大學
八十七學年度碩士班招生考試試題

所 別：工程技術研究所
學程別：自動化及控制學程

組別：自動化工程組、控制組

科目：工程數學

6. Find the solution $u(x,t)$ of the problem

$$\begin{aligned} u_{tt} &= c^2 u_{xx} + h, & 0 < x < L, t > 0 \\ u(x,0) &= 0 \\ u_t(x,0) &= 0 \\ u(0,t) &= 0 \\ u(L,t) &= 0 \end{aligned}$$

where c and h are constants. (20%)

7. Assuming that the mechanical system shown below is at rest before excitation force $P \sin \omega t$ is given. Using the Laplace transform method, derive the complete solution $x(t)$. The displacement x is measured from the equilibrium position before the excitation force is given. (20%)

