

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： 機械工程技術研究所
學 程 別：

組 別： 固力與設計、製造、熱流、控制、材料組

科 目： 工程數學

1. Solve the differential equation (20%)

$$y \frac{d^2 y}{dx^2} = \left(\frac{dy}{dx} \right)^2$$

2. Solve the integral equation (20%)

$$Y(t) = t^2 + \int_0^t Y(u) \sin(t-u) du$$

3. Prove that (20%)

$$\oint_c \frac{dz}{(z-a)^n} = \begin{cases} 2\pi i, & n=1 \\ 0, & n=2, 3, 4, \dots \end{cases}$$

where c is a simple closed curve bounding a region having $z = a$ as interior point.

4. Determine the value of the integral (20%)

$$\oint_c [(1+y)zdx + (1+z)xdy + (1+x)ydz]$$

where c is the triangle with vertices at $P_1(1,0,0)$, $P_2(0,1,0)$, $P_3(0,0,1)$, oriented from P_1 to P_2 .

5. Find the solution of the steady-state heat conduction problem associated with a solid disk of radius a where the temperature satisfies

$$\nabla^2 T(r, \theta) = 0 \quad (r \leq a), \quad T(a, \theta) = f(\theta) \quad (20\%)$$

and prove that the temperature at the center of the circle is the mean of the temperature distribution along the boundary of the circle.