

國立臺灣科技大學

九十四學年度碩士班招生考試試題

系所組別：化學工程系碩士班

科 目：工程數學

總分 100 分，請依序作答，並詳列計算過程。

1. Solve the differential equation: $\frac{d^2y}{dx^2} + y = \sec x$ (15%)

2. Find the solution of a differential equation

$$t \frac{d^2y}{dt^2} - t \frac{dy}{dt} - y = 0 ; y(0) = 0, \frac{dy}{dt}(0) = 5 \quad (15\%)$$

3. Evaluate $\oint_c (x^5 + 3y)dx + (5x - e^{y^3})dy$, where c is the circle

$$(x-1)^2 + (y-5)^2 = 4 . \quad \text{The curve is oriented counterclockwise.} \quad (10\%)$$

4. (a) What is the difference between an ordinary differential equation and a partial differential equation?

(b) What are the even function and odd function?

(c) Write the function value in the form $a + bi$ for e^i . (12%)

5. Find the eigenvalues and eigenvectors for matrix $A = \begin{pmatrix} 5 & -4 & 4 \\ 12 & -11 & 12 \\ 4 & -4 & 5 \end{pmatrix}$ (15%)

6. Find the power series solution for ODE $x^2 y'' + 5xy' + (x+4)y = 0$. (15%)

7. Solve the heat conduction problem in an infinite bar: (18%)

$$\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2} \quad \text{for } -\infty < x < \infty, \quad t > 0$$

$$u(x, 0) = g(x) \quad \text{for } -\infty < x < \infty$$

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