

國立臺灣科技大學
九十四學年度博士班招生考試試題

系所組別：機械工程系甲一組、甲二組、乙組、丙組、丁組、戊組
科目：工程數學

ENGINEERING MATHEMATICS

(Entrance examination for Ph. D. program in ME)

Five problem test, 20 points for each problem(共 5 題,每題 20 分,總分 100 分).

1. Solve the initial value problem

$$y'' + 2y' + 2y = \delta(t-1); y(0) = y'(0) = 0$$

where $\delta(t)$ is the Dirac delta function.

2. Find the general solution of the system of differential equations by matrix method.

$$\begin{aligned} x_1' &= 3x_1 + 3x_2 + 8 \\ x_2' &= x_1 + 5x_2 + 4e^{3t} \end{aligned}$$

3. A position vector, $\mathbf{R} = 3t \mathbf{i} - 2 \mathbf{j} + t^2 \mathbf{k}$, is given. Determine the curvature, the unit tangent, the unit normal, and binormal vectors.

4. Find the Fourier integral of $f(x)$ which is

$$f(x) = \begin{cases} x^2, & -100 \leq x \leq 100 \\ 0, & |x| > 100 \end{cases}$$

Then determine what the Fourier integral converges to at each real number.

5. Solve the following boundary value problem.

$$\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial x^2} \quad (0 < x < L, t > 0)$$

$$u(0,t) = 0, \quad \frac{\partial u}{\partial x}(L,t) = -Au(L,t) \quad (t > 0)$$

$$u(x,0) = f(x) \quad (0 < x < L)$$

(a , A , and L are all constants.)

