

# 國立臺灣科技大學

115學年度碩士班招生

## 試題

系所組別：0310機械工程系碩士班甲組

科    目：工程數學

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(總分為100分;所有試題務必於答案卷內頁依序作答)

1. (25%) Solve the following differential equation :

(1) (10%)  $y' = 2y + x^2 + 5, \quad y(0) = 3$

(2) (15%)  $y'' + y = \sec x$

2. (15%) Solve the following integral equation by Laplace transform,  $f(t) = ?$ 

$$f(t) = \cos(t) + \int_0^t e^{-\tau} f(t - \tau) d\tau$$

3. (10%) Find the inverse matrix of  $A$ ,  $A = \begin{bmatrix} 1 & 3 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ 4. (20%) Given  $w(x, y) = \cosh x$ , evaluate the following integral taken counterclockwise over the boundary  $C$  of the region  $R$ 

$$\oint_C \frac{\partial w}{\partial n} ds$$

where  $R$  is the triangle with vertices  $(0, 0)$ ,  $(4, 2)$ ,  $(0, 2)$ , and  $n$  denotes the outer normal direction of  $C$ .5. (10%) Evaluate  $\oint_C \mathbf{F} \cdot \mathbf{r}' ds$ , where  $C$  is the circle  $x^2 + y^2 = 4$ ,  $z = -3$ , oriented counterclockwise as seen by a person standing at the origin, and, with respect to right-handed Cartesian coordinates,

$$\mathbf{F} = [y, xz^3, -zy^3] = y\mathbf{i} + xz^3\mathbf{j} + -zy^3\mathbf{k}$$

6. (20%) Starting from separation of variables, solve the following boundary value problem:

$$\nabla^2 u = 0 \quad (0 < x < 1, 0 < y < 1)$$

where  $u(x, 0) = 2$ ,  $u(x, 1) = 0$ ,  $u(0, y) = 0$ , and  $u(1, y) = 0$ ,