

國立臺灣科技大學
113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，否則不予計分)

$$1 \cdot (20\%) \mathbf{A} = \begin{bmatrix} 1 & 4 & 3 \\ 2 & 1 & 2 \\ 1 & 2 & 2 \end{bmatrix}$$

- (1) (10%) Find the inverse matrix of \mathbf{A}
- (2) (10%) Find the LU decomposition of \mathbf{A} , which means $\mathbf{A}=\mathbf{LU}$

2 · (30%) Solve the following ODE:

- (1) (10%) $y'' + y = \delta(t - 2\pi)$, $y(0)=1$, $y'(0) = 0$
- (2) (10%) $y'' - 2y' + y = e^x$
- (3) (10%) $(xy) \frac{dy}{dx} = 2y^2 + 3x^2$

3 · (10%) Find the volume of the tetrahedron if the vertices are $(1, 1, 1)$, $(5, -7, 3)$, $(7, 4, 8)$, and $(10, 7, 4)$.

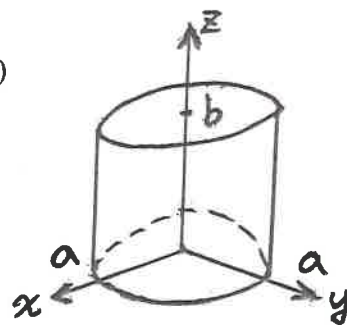
4 · (20%) Evaluate the surface integral

$$I = \iint_S (x^3 dydz + x^2 ydzdx + x^2 zdx dy)$$

where S is the closed surface in the following figure consisting of the cylinder $x^2 + y^2 = a^2$

$(0 \leq z \leq b)$ and the circular disks $z=0$ and $z=b$ ($x^2 + y^2 \leq a^2$)

- (1) (10%) Compute the surface integral I directly.
- (2) (10%) Check the result by the divergence theorem.



5 · (20%) Starting from separation of variables, solve the following partial differential equation:

$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2} \quad (c \text{ and } L \text{ are constants.})$$

Boundary conditions : $u(0, t) = u(L, t) = 0$ for all $t \geq 0$

Initial conditions : $u(x, 0) = f(x)$ ($0 \leq x \leq L$).

where

$$f(x) = \begin{cases} x & \text{if } 0 < x < \frac{L}{2} \\ L-x & \text{if } \frac{L}{2} < x < L \end{cases}$$

