

國立彰化師範大學 102 學年度博士班招生考試試題

系所：工業教育與技術學系

組別：乙組

科目：工程數學

☆☆請在答案紙上作答☆☆

第 1 頁，共 1 頁

● 共 100 分每題配分置於題目後面

1. Find the general solution of the following differential equation. (10%)

$$xy' = \frac{y^2}{x} + y.$$

2. Solve for $u = u(x, y)$. (15%)

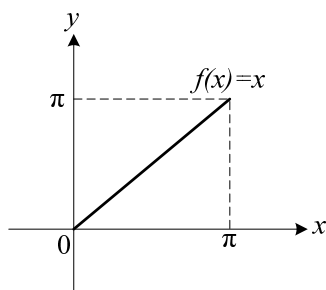
$$x^2 \frac{\partial^2 u}{\partial x \partial y} + x \frac{\partial u}{\partial y} = y.$$

3. The temperature distribution is given as $T(x, y, z) = x^2 + 2y^2 + 3z^2$, find the directional derivative at point $(0, 1, 2)$ in the direction of $\vec{a} = [1, 1, 1]$. (15%)

4. Find the tangent plane and the normal line to the following surface S at the given point P . (10%)

$$S: z = x^2 - 2y + 4, \quad P: (1, 1, 3).$$

5. Find the Fourier sine series of $f(x) = x$, which is defined for $0 \leq x \leq \pi$ only. (12%)



6. Find the Fourier transform (complex form) of the following function. (12%)

$$f(x) = \begin{cases} \sin x, & -\pi < x < \pi \\ 0, & \text{otherwise.} \end{cases}$$

7. Using Laplace transform to solve the following differential equation. (12%)

$$y'' - 2y' - 3y = f(t) = \begin{cases} 0, & t < 2 \\ 1, & t \geq 2. \end{cases} \quad y(0) = 1, \quad y'(0) = 0.$$

8. Given $A = \begin{bmatrix} 1 & 0 \\ 1 & 2 \end{bmatrix}$, $f(x) = x^3 - 2x^2 + x - 2$.

(a) Find $f(A) = ?$ (8%)

(b) Find $e^A = ?$ (6%)