

國立彰化師範大學 98 學年度碩士班招生考試試題

系所：工業教育與技術學系

組別：乙

科目：工程數學

☆☆請在答案紙上作答☆☆

共 2 頁，第 1 頁

※ 共佔 100 分每題配分置於題目前面

(一) (8 分) To solve $y' + xy = \frac{x}{y^3}$

(二) (8 分) To solve $y'' - 2y' + y = e^x + x$

(三) (8 分) To solve $x^3 y^{(3)} - 5x^2 y'' + 18xy' - 26y = 0$

(四) (8 分) Use the Laplace Transform to solve $y'' + y = 1$, $y(0) = 6$; $y'(0) = 0$

(五) (8 分) To solve $y'' + \cos(x)y' + 4y = 2x - 1$, $y(0) = a$; $y'(0) = b$

(六) (10 分) (1) To find $\mathcal{L}[e^t(1 - \cosh t)]$

(2) To find $\mathcal{L}^{-1}\left[\frac{se^{-3s}}{s^2 + 4}\right]$

(七) (10 分) Find the Fourier series of the function

$$f(x) = \frac{x^2}{2} \quad (-\pi < x < \pi) \quad f(x + 2\pi) = f(x) \quad \text{and}$$

show that $1 - \frac{1}{4} + \frac{1}{9} - \frac{1}{16} + \dots = \frac{\pi^2}{12}$

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共 2 頁，第 2 頁

(八) (10 分) Find the eigenvalues and the eigenvectors of the following Matrix and diagonalize the matrix,

$$\mathbf{A} = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & 0 \\ -2 & 0 & 4 \end{bmatrix},$$

(九) (10 分) Reduce the quadratic form to principal axes. Express $[x_1, x_2]^T$ in terms of the new variable. (Show the details)

$$17x_1^2 - 30x_1x_2 + 17x_2^2 = 32$$

(十) (10 分) Solve:

$$\left\{ \begin{array}{l} \frac{\partial^2 u(x,t)}{\partial t^2} = c^2 \frac{\partial^2 u(x,t)}{\partial x^2} \\ u(0,t) = u(\ell,t) = 0 \\ u(x,0) = k \sin \frac{3\pi x}{\ell}, \quad u_t(x,0) = 0 \end{array} \right. , \text{ where } c \text{ and } k \text{ are constant.}$$

(十一) (10 分) Evaluate (Show details)

(a) $\int_{-\infty}^{\infty} \frac{\sin 3x}{(1+x^4)} dx = ?$