

國立彰化師範大學 101 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： 乙組

科目： 工程數學

☆☆請在答案卷上作答☆☆

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1. Given the matrix $A = \begin{bmatrix} 0 & -2 \\ 1 & 3 \end{bmatrix}$, Calculate

(1) all eigenvalues of A . (8%)

(2) all corresponding eigenvectors of A . (8%)

(3) e^A . (8%)

2. Find the gradient and unit normal vector \bar{n} to the surface of $z^2 = x^2 - y^2$ at the point $(0, 1, 2)$. (10%)

3. Solve the equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$, with $u(0, t) = 0$, $u(2, t) = 0$, and $u(x, 0) = 2$. (12%)

4. Find the inverse Laplace transform of $Y(s) = \frac{5}{s^2(s+1)^2}$. (10%)

5. Use the Laplace transform method to solve the following system (12%)

$$\begin{cases} x_1' = 6x_1 + 9x_2 \\ x_2' = x_1 + 6x_2 \end{cases}, \quad x_1(0) = 0, \quad x_2(0) = -1.$$

6. Solve the following differential equations

(1) $y' + (\tan x)y = \sin 2x$, $y(0) = 2$. (10%)

(2) $y'' - 2y' - 3y = 2e^{-2x}$. (12%)

7. Given a periodic function $f(x) = \begin{cases} -1, & -2 < x < 0 \\ 1, & 0 < x < 2 \end{cases}$, find the Fourier series of $f(x)$. (10%)