

中原大學 104 學年度碩士班考試入學

104/3/4 8:00 AM~9:30 AM

誠實是我們珍視的美德，
我們喜愛「拒絕作弊，堅守正直」的你！

機械工程學系乙組

科目：工程數學【分工程數學(A)、工程數學(B)兩部份計分，各佔 50 分】(共 1 頁，第 1 頁)

可使用計算機(僅限於四則運算、三角函數及對數等基本功能，可程式之功能不可使用)

不可使用計算機

(A) 部分，共 50 分

1. Find the general solution of the given differential equation. . (15%)

$$x^2 y'' - xy' + y - x \ln x = 0 ; y(1) = y'(1) = 0$$

2. Expand the given function in a Fourier Series in complex form. . (15%)

$$f(x) = f(x + 2\pi) = 2\pi x - x^2 \text{ for } 0 \leq x \leq 2\pi$$

3. Use Laplace transform to find the solution of the given differential equation with the given conditions. (20%)

$$y'' + 9y - \cos 2x = 0 ; y(0) = 1 ; y(\pi/2) = -1$$

(B) 部分，共 50 分

4. Find the (a) inverse matrix, (b) determinant, and (c) rank of A. (15%)

$$A = \begin{bmatrix} 0 & 4 & 5 \\ 2 & 1 & -3 \\ 6 & -1 & 2 \end{bmatrix}$$

5. The velocity of a rotating particle is given by a vector $\vec{v} = \vec{\omega} \times \vec{r}$, where $\vec{\omega}$ is a constant vector. Find the value of $\nabla \times \vec{v}$ (15%)

6. Solve the partial differential equation. (20%)

$$\frac{\partial u}{\partial x} = \frac{\partial^2 u}{\partial t^2}$$

Where $u(x, t)$ satisfies the following requirements

$$u(x = 0, t) = 200\pi \cdot \sin(200\pi t) \text{ for all } 0 \leq t < 1,$$

$$u(x, t = 0) = u(x, t = 1) = 0 \text{ for all } x \geq 0.$$