

中原大學 102 學年度 碩士班 入學考試

102/3/2 10:00 ~ 11:30 機械工程學系丙組

誠實是我們珍視的美德，
我們喜愛「拒絕作弊，堅守正直」的你！

科目：工程數學

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可使用計算機，惟僅限不具可程式及多重記憶者

不可使用計算機

【1-3 題為工程數學(A)，4-6 題為工程數學(B)】

1. (15 points) Let $y = y(x)$. Solve $(e^y + 1)^2 e^{-y} dx + (e^x + 1)^2 e^{-x} dy = 0$, $y(0) = 0$

2. (15 points) Solve $y''(x) + 4y'(x) + 4y(x) = 4\cos x + 3\sin x$, $y(0) = 1$, $y'(0) = 0$

3. (15 points) Use Laplace transforms to solve

$$\begin{cases} y_1''(t) = -5y_1(t) + 2y_2(t) \\ y_2''(t) = 2y_1(t) - 2y_2(t) \end{cases}, y_1(0) = 3, y_2(0) = 1, y_1'(0) = y_2'(0) = 0$$

4. (15 points) Given a surface $z = e^{2x} \sin 3y$, find the plane tangent to the surface at point $(0, \frac{\pi}{12}, 3)$.

5. (20 points) Find the work done by the force $\vec{p} = 4xy\vec{i} - 8y\vec{j} + 2\vec{k}$ along the straight line $y = 2x, z = 2x$ from point $(0, 0, 0)$ to point $(3, 6, 6)$.

6. (20 points) Given $f(x) = L - x$, $0 < x < L$, represent $f(x)$ by a Fourier sine series.

Hint: $f(x) = \sum_{n=1}^{\infty} b_n \sin \frac{n\pi}{L} x$, where $b_n = \frac{2}{L} \int_0^L f(x) \sin \frac{n\pi x}{L} dx, n = 1, 2, \dots$