中原大學 100 學年度 碩士班 入學考試

3 月 19 日 10:30~12:00　　機械工程學系甲組　　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 　　　　　　　　　　　　　　　（共 1 頁第 1 頁）

□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. Please find the solution of $y''+3y'+2y = 2x^2$ **(15%)**

2. Please determine the radius of convergence.

   a. $\sum_{n=0}^{\infty} \dfrac{(m+1)m}{2^m}(x-3)^{2m}$ (8%)

   b. $\sum_{m=0}^{\infty} \dfrac{(m+3)^2}{(m-3)^4}x^m$ (7%)

3. Please find the solution of $\begin{cases} y_1' = 4y_1 + 3y_2 + 2 \\ y_2' = -6y_1 - 5y_2 + 4e^{-t} \end{cases}$ (15%)

4. Please find the solution of $y''+y = u(t-1); y(0) = o, y'(0) = 20$, where

   $u(t-1)$ is unit step function. (10%)

5. Please find the Laplace inverse transforms, $L^{-1}\left[\dfrac{s+2}{s^2(s-1)^2}\right]$ (10%)

6. Suppose a periodic function f(t) with period is defined as $f(t) = \begin{cases} \dfrac{1}{k}, 0 \le t \le k \\ 0, k \le t < 2 \end{cases}$

   , where k is a constant (0<k<2). Please expand f(t) in a Fourier series. (10%)

7. Find the Fourier transforms of the following function. (15%)

   $f(x) = \begin{cases} -1, -1 < x < 0 \\ 1, 0 < x < 1 \\ 0, otherwise \end{cases}$

8. $f(x,y,z) = xe^{yz}$, please find $div(\nabla f)$. (10%)