# 大同大學 九十二 學年度 轉學考試 試題

考試科目：工程數學　系別：機械工程學系　　第 1 頁，共 1 頁

註：本次考試不可以參考自己的書籍及筆記；　不可以使用字典；　不可以使用計算器。

1. (7 points) Find the general solution of the following differential equation:

   $\sin(2x)y' + 2y\sin^2(x) = 2\sin(x)$.

2. (10 points) Solve the following differential equation:

   $x^2y'' - 5xy' + 8y = 2\ln(x)$.

3. (8 points) Solve the following differential equation:

   $(y - 3x^3y^3)dx + xdy = 0$.

4. (10 points) Find the Fourier series of the function $f(x)$ that is equal to $x$ for $0 < x < 2L$ and is $2L$-periodic.

5. (15 points) Solve the $\frac{\partial T}{\partial t} = \alpha\frac{\partial^2 T}{\partial X^2}$ problem, $0 < x < L$, $t > 0$, the boundary conditions are $\left.\frac{\partial T}{\partial X}\right|_{X=0} = Q_o$, $T(L,t) = T_L$ and the initial condition is $T(x,0) = f(x)$, here $T_L$ and $Q_0$ are constants.

6. (10 points) Solve the following equation: $z^5 + z^4 + z + 1 = 0$.

7. (15 points) For a function $f(z) = z^5 + 1$, find the values of $u$ and $v$ such that $u + iv = f(3 + 2i)$.

8. (10 points) Let $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$. Find $A^{-1}$.

9. (15 points) Let $A^T = [1 \quad 2], B = [3 \quad 4]$. Which one(s) of the following matrix multiplications: $(AB)^T$, $AB^T$ and $A^TB^T$, exist(s)? What is the result?