# 淡江大學九十三學年度碩士班招生考試試題

系別：化學工程與材料工程學系　　科目：工　程　數　學

| 准帶項目請打「○」否則打「×」 |
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| 簡單型計算機 |
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**Problem One (20 %)**
Solve the following system of differential equations.

$$\begin{pmatrix} x_1' \\ x_2' \end{pmatrix} = \begin{pmatrix} 0 & 8 \\ 2 & 0 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} e^{3t} \\ t \end{pmatrix}$$

Hint: $\int ue^{au}du = \frac{au-1}{a^2}e^{au} + C$

**Problem Two (20 %)**
Solve the following partial differential equation.

$$\frac{\partial U}{\partial t} = 3\frac{\partial^2 U}{\partial x^2}$$

I.C. $U(x, 0) = 1$

B.C. $U(0, t) = U(1, t) = 0$

**Problem Three (20 %)**
Solve the following differential equation.

$$y'' + y = \tan(x)$$

Hint: $\int \sec(x)dx = \ln|\sec(x) + \tan(x)| + C$

**Problem Four (20 %)**
Find the inverse of the following matrix.

$$\begin{pmatrix} -1 & 1 & 16 & 2 \\ 0 & 0 & 1 & 4 \\ 0 & 0 & 1 & 6 \\ 0 & 1 & 1 & -3 \end{pmatrix}$$

**Problem Five (20 %)**
Find the first three terms in a power series expansion about $x = 0$ for a general solution to the following differential equation.

$$x^2y'' + \frac{x}{2}y' + 2x^2y = 0$$