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：化學工程學系　　

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. Solve the following ordinary differential equations. (20%)

1a $$\frac{dy}{dx}=\frac{x^2+2y^2}{xy}$$

1b $$\frac{dy}{dx}+2y-2(\cos x+\sin x)\sqrt{y}=0$$

2. Solve the following initial-value ordinary differential equation. (10%)

$$y'''-y'=t^2+1 \qquad y(0)=2, \quad y'(0)=0, \quad y''(0)=3$$

3. Solve the following system of differential equations. (15%)

$$\frac{d}{dt}\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}=\begin{bmatrix}2&0&0\\-2&1&-2\\1&0&3\end{bmatrix}\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix} \qquad IC: t=0, \quad \begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}=\begin{bmatrix}2\\3\\1\end{bmatrix}$$

4. Solve the following differential equations resulted from mathematical modeling of a semi-batch reactor: (20%)

$$\frac{dV}{dt}=Q \qquad \text{IC: } t=0,\ V=V_0$$

$$\frac{d(CV)}{dt}=QC_f-kCV \qquad \text{IC: } t=0,\ C=0$$

where Q, k, and C_f are constants.

5. Solve the following partial differential equation (35%)

$$\frac{\partial C_A}{\partial t}=D_{AB}\frac{\partial^2 C_A}{\partial x^2}-kC_A \qquad 0\le x\le L$$

IC: $t=0, \quad C_A=0 \quad 0\le x\le L$

BC1: t > 0, at $x=0, \quad \frac{\partial C_A}{\partial x}=0$

BC2: t > 0, at $x=L, \quad C_A=C_{A0}$