

大同大學 九十二 學年度 轉學考試 試題

考試科目：工程數學

系列：化學工程學系

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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%)

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

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

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

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

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

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

where Q , k , and C_f are constants.

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

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

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

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

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