

國立臺北科技大學

九十三年學年度環境規劃與管理研究所入學考試

工程數學試題

填准考證號碼

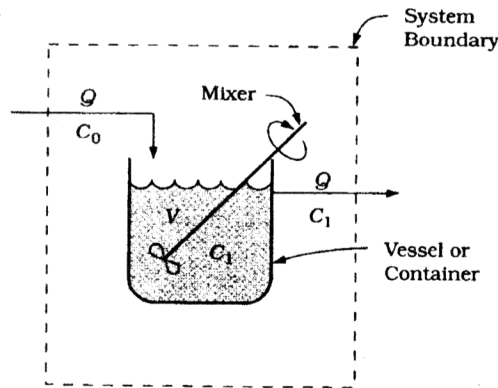
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注意事項：

1. 本試題共五題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

- (1) A complete-mixed reactor is shown in the following figure. Please derive the time variant solution (non steady-state) for the mass balance equation, assuming first order reaction. (20 分)



- (2) Find a complete solution of the equation $y'' + 5y' + 6y = 3e^{-2x} + e^{3x}$ (20 分)
- (3) What is the Fourier expansion of the periodic function whose definition in one period is
- $$f(t) = \begin{cases} 0, & -\pi \leq t \leq 0 \\ \sin t, & 0 \leq t \leq \pi \end{cases} \quad (20 \text{ 分})$$
- (4) Find the solution of the initial-value problem $y'' - 10y' + (25 + \pi^2)y = 0$; $y(0) = 0$, $y'(0) = \pi e$. (20 分)

- (5) A membrane concentration profile (x vs. c) under steady state is shown in the following figure. Bulk feed concentration (c_b) pass through membrane becoming permeate concentration (c_p). However, solute will accumulate on the membrane surface to have higher concentration (c_m). Form Fick's law, the membrane will diffuse back to the bulk solution ($D \frac{dc}{dx}$). J =flux ($L^3/L^2 t$) and D =diffusion coefficient (L^2/T). Please write the mass balance equation and solve membrane surface concentration c_m on the boundary layer from 0 to δ . (20 分)

