

大葉大學九十學年度研究所碩士班招生考試試題紙

系 所 組 別	考 試 科 目 (中文名稱)	考 試 日 期	備 註
環境工程學系 碩士班	工程數學	4 月 22 日 第 1 節	共乙頁

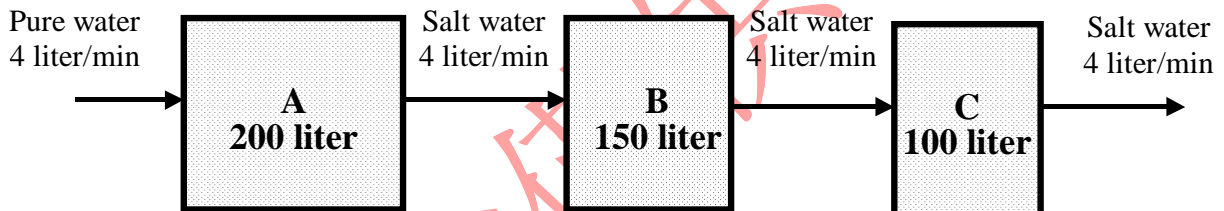
註：考生可否攜帶計算機或其他資料作答，請在備註欄註明（如未註明，一律不准攜帶）

(1. 詳列計算步驟，否則一概不計分！ 2. 答題可不依順序，但必須標註題號！)

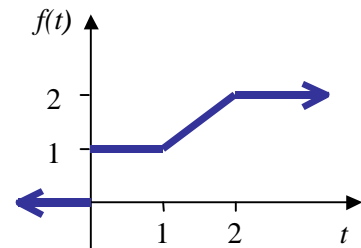
1. Three tanks of different size are connected by a pipeline as shown in figure below. Initially, three cups of salt with **10g, 40g and 70g** are put into A, B and C tank separately to mix well with water. Starting the system to mix the three tanks as the flow rate shown in figure and measuring the amount of salt in three tanks. Then
- (a) Formulate the **system of ODEs**? [10%]

- (b) Solve the **particular solution** by initial conditions? [20%]

(Hint: Set $y_1(t)$, $y_2(t)$, $y_3(t)$ as the amount of salt in A, B, C tank. By using the continuity equation as $dy/dt = (\text{inflow rate of salt}) - (\text{outflow rate of salt})$, then you can formulate the system of 1st order ODEs)



2. (a) By using **Unit Step Function** to compose $f(t)$ as shown in right figure? [10%]
- (b) Find the **Laplace Transform F(s)** of $f(t)$ [10%]



3. Solve the differential equation $y'' + 2y' + y = -3e^{-x} + 8xe^{-x} + 1$? [20%]

(Hint : by using the method of undetermined coefficient for particular solution. Be careful the special condition of double roots for eigen value)

4. Solve the heat equation $u_t = 4u_{xx}$ ($0 \leq x \leq 3$) by the **method of Laplace transform** with the B.C. as $u(0,t) = u(3,t) = 0$ and I.C. as $u(x,0) = 10 \sin 2\pi x$? [20%]

5. Transform the $y(x)$ differential equation $4x^2y'' + 4xy' + (x-4)y = 0$ into a standard form of **Bessel equation** of $U(z)$ where $z = x^{1/2}$ and $U' = dy/dz$, $U'' = d^2y/dz^2$? [10%]