

大葉大學 九十三年 學年度 研究所碩士班 招生考試試題紙

系所別	組別	考試科目 (中文名稱)	考試日期	節次	備註
環境工程學系 碩士班	甲	工程數學	3月28日	第1節 08:30 ~ 10:00	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. 請詳列計算步驟，否則扣分！ 2. 答題可不依順序，但必須標註題號！)

1. Solve the ODE  $2(x-1)^2y''+6(x-1)y'+4y=0$  for general solution? [15%]

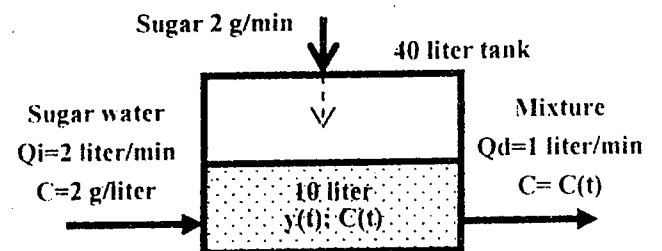
[Hint: Set  $(x-1)=X$  to convert a standard form of Euler-Cauchy Equation]

2. A 40 liter tank contains 10 liter of water mixed well with 10g sugar initially. Then, the 2 g/liter concentration sugar water with 2 liter/min rate runs into the tank. Also, there is 2 g/min sugar dropped from top of tank in the same time. Then after, the mixture discharges with 1 liter/min rate from tank. Find the amount of sugar  $y(t)$  in the tank at any time  $t$ .

① Derive the ODE for  $y(t)$ ? [5%]

② Find the solution for the ODE? [10%]

③ How much the sugar in tank in 10 min later? [5%]

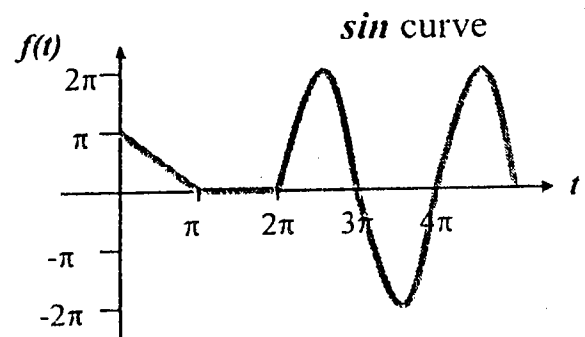


3. Solve the ODE  $y''+4y'+4y=2e^{-2x}$  for  $y(x)$  with initial conditions of  $y(0)=2$  and  $y'(0)=0$ ? [15%]

4. Try to expand the periodical function  $f(x)=\begin{cases} 3 & (-4\pi < x < 0) \\ -1 & (0 < x < 4\pi) \end{cases}$  to *Fourier series* and show the previous five terms of the series. [15%]

5. Find the *Laplace transform* of  $f(t)$  as shown in figure? [15%]

[Hint: try to convert figure to a standard form composed by unit step function  $u(t)$ ]



6. Find the *inverse* of matrix  $[A]=\begin{bmatrix} 1 & 0 \\ 6 & -1 \end{bmatrix}$  and try to calculate the *eigen values* and *eigen vectors* of matrix  $[A]$ ? [20%]