國立高雄大學九十七學年度研究所碩士班招生考試試題

科目：工程數學
考試時間：100 分鐘

系所：
土木與環境工程學系碩士班土木工程組　是否使用計算機：是
本科原始成績：100 分

1. Solve the logistic differential equation $\frac{dy}{dt} = ky\left(1-\frac{y}{L}\right)$, where k and L are positive constants.

(20)

2. Solve the boundary value problem $\frac{\partial u}{\partial t} = c_v \frac{\partial^2 u}{\partial z^2}$ $(0 \le z \le 2H,\ t \ge 0)$ with the following boundary conditions:

$$u(z,0) = u_0$$
$$u(0,t) = 0 \text{ and } u(2H,t) = 0 \text{ if } t > 0$$

where c_v, H and u_0 are positive constants. (30)

3. (a) Show how to find a particular solution by variation of parameters (15).

Consider a 2nd Order linear non-homogeneous ODE in (1)

$$y'' + p(x)y' + q(x)y = r(x) \quad (1)$$

One may find two basis functions to form the general solution for the ODE.

$$y_h = c_1 y_1 + c_2 y_2 \ (c_1, c_2 = \text{const}) \quad (2)$$

And obtain the particular solution y_p of (1) in the form

$$y_p(x) = -y_1 \int \frac{y_2 r}{W}\,dx + y_2 \int \frac{y_1 r}{W}\,dx \quad (3)$$

where $W = y_1 y'_2 - y_2 y'_1$.

(b) Use (a) to find the complete solution to the ODE, $y'' - 2y' + 2y = 2e^x \cos x$ (15).

4. Consider a system of two tanks as shown below. Find the salt content for each tank if the system can be modeled as

$$y_1'' = 4y_2 - 4e^t,\ y_2'' = 3y_1 + y_2,\ y_1(0) = 1,\ y_1'(0) = 2,\ y_2(0) = 2,\ y_2'(0) = 3$$

(20)

背面尚有試題

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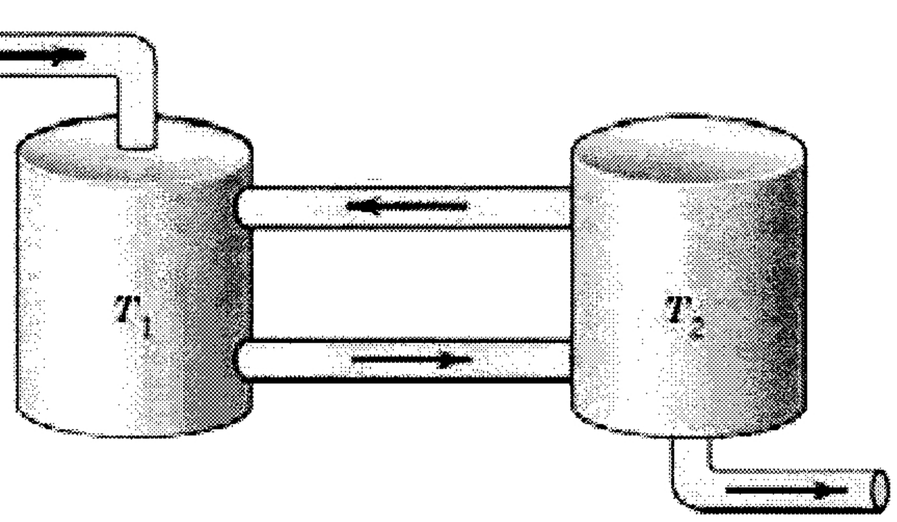

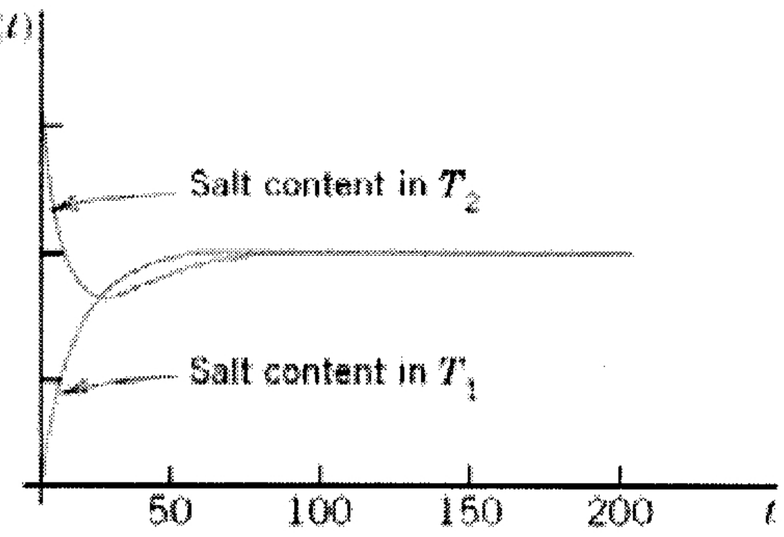

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