

國立臺北科技大學

九十二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

第一頁 共一頁

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注意事項：

1. 本試題共【六】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. Find the general solution of $y'' - \frac{4}{x}y' + \frac{4}{x^2}y = x^2 + 3$ (15%)

2. Solve the initial value problem $y'' - 4y' + 3y = e^t$; $y(0) = 0$, $y'(0) = 1$ (15%)

3. Determine $L[g]$ (note: Laplace Transform) if

$$g(t) = 0 \text{ for } 0 \leq t < 2 \quad \text{and} \quad g(t) = t^2 + 1 \text{ for } t \geq 2$$

(Hint: $L[t^n] = \frac{n!}{s^{n+1}}$ and $L^{-1}[e^{-as}F(s)] = f(t-a)H(t-a)$) (15%)

4. Find the general solution of $X' = AX$ with $A = \begin{pmatrix} 1 & -4 \\ 1 & 5 \end{pmatrix}$ (15%)

5. A particle with initial velocity V_0 will travel in still air in the absence of external forces. The air molecules will retard the motion of particle. Please derive equations to express the particle velocity and the total distance traveled. Make appropriate assumption if necessary. (20%)

6. Two tanks are connected by a series of pipes, as in the figure shown below. Tank 1 (T1) initially contains 20 liters of water in which 150 grams of chlorine are dissolved. Tank 2 (T2) initially contains 50 grams of chlorine dissolved in 10 liters of water. Beginning at time $t=0$ pure water is pumped into tank 1 at a rate of 3 liters per minute, while chlorine/water solutions are interchanged between the tanks and also flow out of both tanks at the rates shown in the figure. Determine the amount of chlorine in each tank at any time $t > 0$. Make appropriate assumption if necessary. (20%)

