國立臺北科技大學

九十三學年度化學工程系碩士班入學考試

工程數學試題

填准考證號碼

注意事項：

1. 本試題共 5 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 500-gallon tank initially contains 100 gallons of brine in which 5 pounds of salt have been dissolved. Brine containing 2 pounds per gallon is added at the rate of 5 gallons per minute, and the mixture is poured out of the tank at the rate of 3 gallons per minute. Determine how much salt is in the tank at the moment it overflows. The density of brine is assumed to be constant through out the process. (20%)

2. Solve the following differential equation by Laplace Transformation: (20%)

$$ty'' - 2y' + ty = 0, \quad y(0)=a$$

3. Solve the following partial differential equation: (20%)

$$k\frac{\partial^2 u}{\partial x^2} + r = \frac{\partial u}{\partial t}, \quad \text{k and r are constant}$$

$$u(0,t)=0, \qquad u(1,t) = u_0, \qquad t>0$$

$$u(x,0)=f(x), \qquad 0<x<1$$

4. Evaluate flux integral $\iint_S F \cdot n dA$, where n is the unit normal vector of the surface S

$F = x^2\vec{i} + e^y\vec{j} + \vec{k}$, Surface S: $x + y + z = 1$ for $x \geq 0$, $y \geq 0$, $z \geq 0$. (20%)

5. Solve the following differential equation (20%)

$y'' - 4y' + 4y = (x+1)e^{2x}$