

大同大學 100 學年度轉學入學考試試題

考試科目：工程數學

所別：化學工程學系

第 1/1 頁

註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器。

所有題目做答都要詳列計算過程或說明才給分，如果題目無法求解或條件不足，請詳述原因與自行假設所需參數。

1. (20%) Solve $4x^3y - 6e^y + (x^4 - 6xe^y)y' = 0$
2. (20%) Solve $x^2y'' - 2xy' + 2y = 10\sin(\ln(x))$; $y(1) = 3$, $y'(1) = 0$
3. (20%) Find all eigenvalues and nontrivial solutions for the differential equation.

$$y'' - 8y' + (4 - \lambda)y = 0; \quad y(0) = 0, \quad y(8) = 0$$

4. (20%) Solve $\frac{\partial u}{\partial t} = 9\left(\frac{\partial^2 u}{\partial x^2}\right)$; $0 < x < \pi$, $t > 0$

$$u(0, t) = 10$$

$$u(\pi, t) = 10$$

$$u(x, 0) = 30$$

5. (20%) As shown in figure, a 200-L tank initially contains 100 L of brine solution in which 10 kg of salt have been dissolved with well mixed. Beginning at time zero, brine solution containing 0.2 kg of salt per liter is added at the rate of 5 liter per minute, and the mixture is poured out of the tank at the rate of 5 liter per minute. How much salt in the tank at any time t ? How much salt in the tank while the system is steady state?

