國立高雄應用科技大學
100 學年度碩士班招生考試
化學工程與材料工程系

准考證號碼□□□□□□□□□□ （考生必須填寫）

單元操作及輸送現象

試題 共有 2 頁，此為第 1 頁

注意：a. 本試題共 6 題，總分為 100 分。
b. 作答時不必抄題。
c. 考生作答前請詳閱答案卷之考生注意事項。

1. Please give the S. I. units of the following terms: (10%)
   (1) mass transfer coefficient
   (2) rate of strain
   (3) thermal conductivity
   (4) viscosity
   (5) net positive suction head

2. Please give the physical meaning of the following dimensionless groups in terms of ratio of physical quantities. (10%)
   (1) Reynolds number
   (2) Nusselt number
   (3) Sherwood number
   (4) Prandlt number
   (5) Biot number

3. 欲將溫度為 400 K、流量為 0.02 $kg \cdot s^{-1}$ 的機油，與相同流量、溫度為 280 K 的水進行熱交換的操作，使用的是逆流式(counterflow)的套管熱交換器。請問機油從 400 K 冷卻到 350 K 時，熱交換器所需要的長度應為多少？（內管的外徑為 2 ㎝；以內管外側的表面面積為基準的總熱傳係數是 230 $W \cdot m^{-2} \cdot K^{-1}$；油與水的比熱分別是 1880 與 4175 $J \cdot kg^{-1} \cdot K^{-1}$）(20%)

下頁尚有試題

4. A *Newtonian* fluid flows through a slit made up of two parallel flat plates a distance 2B apart (Figure 1). Please find the momentum and velocity profiles.(The thickness, width, and length of flat plate is x, W, and L) (20%)

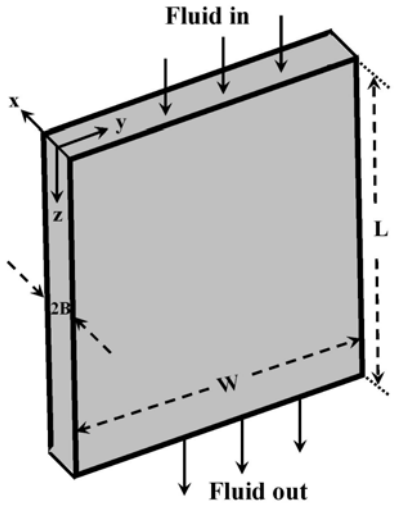

Figure 1.

5. 在 1atm 下,利用蒸餾塔將 50 mol%甲醇水溶液加以分離。進料物為 100 kgmol/hr 的飽和液體，經分離後得到的塔頂產物為 90 mol%的甲醇，以及 5 mol%甲醇的塔底產物。每一莫耳(mol)的塔頂產物將有一莫耳的液體回流至蒸餾塔中。請回答下列問題（不需做圖）：(20%)
   (1) 請寫出精餾段的操作線與進料方程式，並計算各線的斜率。
   (2) 請求出塔頂產物與塔底產物的莫耳流率。
   (3) 請計算汽提段(stripping section) L/V 的比值。

6. A metal sphere of radius r_0 and thermal conductivity *k* is initially in equilibrium at 350℃ in a furnace. It is suddenly removed from the furnace and cooling in air at 30℃. The convection heat transfer coefficient for this cooling process is *h*. (20%)
   (1) Please write the conservation equation of the transient conduction occurs in the sphere.
   (2) What are the initial condition and the boundary conditions of this system?
   (3) Under what physical condition the temperature in the sphere can be regarded as uniform?
   (4) Write the approximate energy balance equation for the transient conduction in this solid sphere if the lumped capacitance method can be applied.