明新科技大學九十三學年度研究所碩士班 [V]一般生 [ ]在職生 招生考試入學試題卷

系所別	組別	科目	准考證號碼	考試日期	節次	時間
化工研究所		輸送現象與單元操作		93 年 5 月 2 日	第 2 節	100 分鐘

☆ 可使用*非記憶式*電子計算機。

1. Define and explain the physical meaning of the following dimensionless groups:
   (a)N_{Re}(Reynold number) 3%
   (b)Npr(Prandtle number) 3%
   (c)Nsc(Schmit number) 3%
2. A incompressible Newtonian fluid flowing in laminar flow in the *x* direction between two parallel plates(width W, thickness 2B, length L, and B<<W<<L) under a pressure drop P_0-P_L. Find:
   (a)Velocity profile of the fluid flow 4%
   (b)The ratio of maximum and average velocity 4%
3. 簡答題
   (a)比較說明 Orifice meter、Rotaimeter、Pitot tube meter 三種流量(速)計之異同 3%
   (b)比較說明 Double pipe heat exchanger 與 Shell and tube heat exchanger 之異同 3%
   (c)說明質量傳送之 Two-film theory 與 Penetration theory 3%
   (d)說明如何利用 McCabe-Thiele 方法計算蒸餾塔之理想板數 3%
   (e)何謂共沸蒸餾(Azeotrope distillation)? 其用途為何? 3%
4. 某雙套管式熱交換器(管長 L = 6m，內管外徑 OD =75mm)，外管為 120℃之飽和水蒸汽而內管入口水流溫度為 20℃(C_p=4.187 kJ/kg·K)出口水溫為 65℃ (C_p=4.184 kJ/kg·K)，設若內管水流速率為 0.3 kg/s，試計算此熱交換器之
   (a)總熱傳速率 3%
   (b)對數平均溫度差 3%
   (c)平均對流熱傳係數 3%
5. 一粒徑為 4 mm 之蔡丸，置放於靜止空氣中(T=318 K，P=101.325 kPa)，設若蔡丸之表面溫度可視為 318 K，且其蒸氣壓為 74 Pa，擴散係數 D_{AB}= 6.92 x 10^{-6} m^2/s，計算此蔡丸之質傳通量. 9%
6. A heavy lubricating oil(μ = 0.2 lb/ft s, k = 0.072 Btu/hr ft °F) at room temperature flows in the clearance between a journal and its bearing. Assume both the bearing and the journal are kept at the same temperature, determine the maximum temperature rise in the lubricant for a velocity of v_x=20 ft/s 10%
7. Water at 300K is flowing at the rate of 10 liter/min in a pipe having an inside diameter (ID) 5 inch. Calculate the Reynolds number. 6%
8. A tank initially contains 1000 Kg of brine containing 10% salt by mass. An inlet stream of brine containing 20% salt by mass flows into the tank at a rate of 20 Kg/min.The mixture in the tank is kept uniform by stirring. Brine is removed from the tank via an outlet pipe at a rate of 10 Kg/min. Find the amount of salt in the tank at any time t, and the elapsed time when the amount of salt in the tank is 200Kg. 10%
9. A mixture of He and H_2 gas is contained in a pipe at 300 K and 1 atm total pressure which is constant throughout. At one end of the pipe at point 1 the partial pressure P_{A1} of He is 0.6 atm and at the other end 20 cm, P_{A2} =0.2 atm. Calculate the flux of He at steady state if D_{AB} of the He-H_2 mixture is 0.687 cm^2/s 10%
10. Flow through a circular tube
    (a)Set up a differential z-momentum balance over a shell of thickness Δr in a circular tube 3%
    (b)Obtain the momentum-flux $\tau_{rz}=(\frac{P_0-P_L}{2L})r+\frac{C_1}{r}$ and velocity distribution. $v_z=\frac{(P_0-P_L)R^2}{4\mu L}[1-(\frac{r}{R})^2]$ 4%
    (c)Obtain the average velocity $\langle v_z \rangle$ and mass flow rate(Hagen-Poiseuille equation) 4%
    (d)Summarize and write all the assumptions 3%