明新科技大學九十四學年度研究所碩士班 [V]一般生 [ ]在職生 考試入學試題卷

所別	科目	准考證號碼(請考生填入)	考試日期	節次	第一頁/共二頁
化學工程研究所	輸送現象與單元操作		94年5月1日	第一節	

☆可使用*非記憶性*電子計算機。

1. 何謂牛頓黏度定律(Newton's Law of Viscosity)？說明該方程式中各符號之單位與物理意義。(10%)
2. 何謂牛頓流體？何謂不可壓縮流體？(10%)
3. 解釋名詞（包括其物理意義）。
   甲、 時間部分微分(Partial time derivative) (3%)
   乙、 時間全微分(Total time derivative). (3%)
   丙、 時間本質微分(Substantial time derivative). (4%)
4. Hagen-Poiseuille 方程式可用來測定毛細管中牛頓流體的黏度。反之，利用已知黏度的牛頓流體可以推求該毛細管的半徑。已知下列數據：

毛細管長, L	50.02 cm
牛頓流體的動力黏度, ν	4.03×10^{-5} m^2/s
牛頓流體的密度, ρ	0.9552×10^{3} kg/m^3
水平毛細管的壓力降, -ΔP	4.829×10^{5} Pa
毛細管中的質量流率, w	2.997×10^{-3} kg/s

試求此毛細管的半徑。(10%)

5. 試由下列條件：

空氣溫度	=	360 °F
壁面溫度	=	500 °F
鰭翼之熱傳導係數	=	60 Btu hr^{-1} ft^{-1} $°F^{-1}$
空氣的熱傳係數	=	120 Btu hr^{-1} ft^{-2} $°F^{-1}$
鰭翼長	=	0.25 ft
鰭翼寬	=	1.2 ft
鰭翼厚	=	0.15 in.

   a) 求出一條長方形鰭翼(Fin)之熱損失 Q (Btu/hr)？(5%)
   b) 此鰭翼(Fin)之散熱效率(η)為何？(5%)
6. By making a mass balance over a volume element (△r) (r△θ) (△z) derive the equation of continuity in cylindrical coordinates. (10%)
7. Please show the detail of a typical distillation column equipped with a total condenser and a partial reboiler. (10%)
8. By means of a plate column, acetone is absorbed from its mixture with air into nonvolatile absorption oil. The entering gas contains 30 mol% acetone, and the entering oil is acetone-free. Of the acetone in the air 95% is to be absorbed, and the concentrated liquor at the bottom of the tower is to contain 10 mol% acetone. The equilibrium relationship is $y_e=1.9x_e$. Plot the operating line and determine the number of ideal stages. (10%)

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9. **The gas CO_2 is diffusing at steady state through a tube 0.30 m long having a diameter of 0.01 m and containing N_2 at 298 K. The total pressure is constant at 1.0 atm. The partial pressure of CO_2 is 456 mmHg at one end and 76 mmHg at the other end. The diffusivity D_{AB} is 1.67×10^{-5} m^2/s at 298 K. Calculate the flux of CO_2 in kgmol/m^2.s for equimolar counterdiffusion. (10%)**

10. **For the case of incompressible flow through a circular pipe of radius R, the velocity profile is parabolic for laminar flow as follows:**

$$v = v_{max}[1 - (r/R)^2]$$

where v_{max} is the maximum velocity at the center and v is the velocity at the radial distance r from the center. Derive an expression for the average velocity v_{av} to use in the overall mass-balance equation.(10%)