

大同大學101學年度研究所碩士班入學考試試題

考試科目：單操與輸送

所別：化學工程研究所

第全頁

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； 可以使用計算器。

1. Define and explain:
(a) Newtonian fluid and non-Newtonian fluid, (b) Prandtl mixing length, and (c) the difference between Biot number and Nusselt number. (15%)
2. What are the definition and physical meaning of Prandtl number? What is its meaning when it equals to 1? (10%)
3. Define and give the units of the following physical quantities: (a) kinematic viscosity (b) heat transfer coefficient (c) thermal conductivity. (15%)
4. Water is flowing into a well-stirred tank at 80 kg/h, and salt (NaCl) is being added at 20 kg/h. The resulting solution is leaving the tank at 100 kg/h, assuming that the concentration of the outlet solution is the same as that within the tank. There is 100 kg of fresh water in the tank at the start of the operation, and the rates of the input and output remain constant thereafter. Calculate the outlet concentration (mass fraction salt) after 2 hours? (10%)
5. Calculate the power required and the pressure which should be developed by a pump of 75 percent efficiency in order to send 20 gal/min of 98 percent sulfuric acid at 68°F from a tank at atmospheric pressure through 1200 ft of 2-in. schedule-40 steel pipe (ID=2.067" , A=0.0233 ft²) to a tank at 12 psig, where the level is 10 ft above that in the lower tank. (10%)
(Given: at 68°F, specific gravity=1.836 ; $\mu=26$ c.p ; 1 ft³=7.48 gal. ; 1 c.p= 6.72×10^{-4} lb/ft-s ; 1 hp=550ft-lb_f/s)
6. A Newtonian fluid flows down an inclined flat plate of length L and width B, as shown in Fig. 1. (a) Derive the differential equation with boundary condition and (b) find the velocity profile. Assume that the thickness of fluid is δ . (20%)

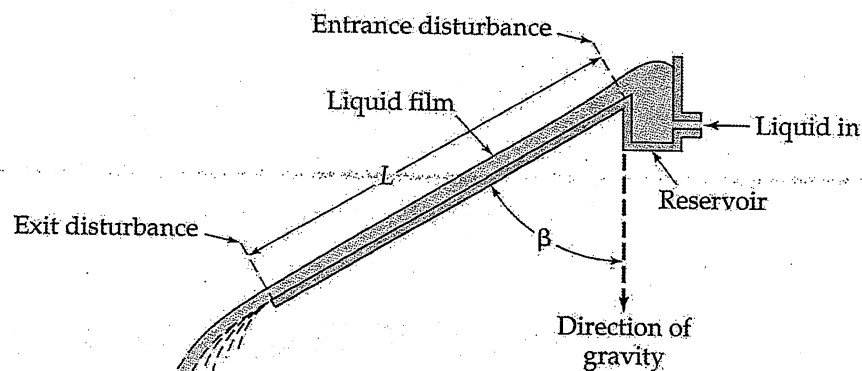


Figure 1

7. Please derive the temperature distribution equation for fully developed laminar Newtonian flow in a circular tube of radius R under the isothermal wall condition. ($T = T_0$ at $r = R$ for $z > 0$ and at $z = 0$ for all y)
Also, assume that $\frac{\partial T}{\partial z}$ will be zero at a large z . (20%)