

# 國立臺北科技大學九十五學年度碩士班招生考試

系所組別：3510 化學工程研究所甲組

## 第一節 單元操作與輸送現象 試題

填准考證號碼

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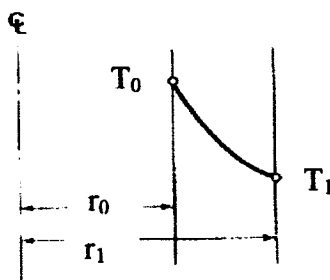
第一頁 共一頁

### 注意事項：

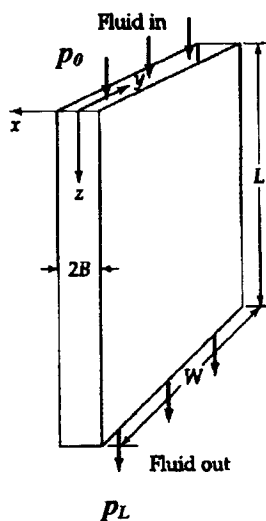
1. 本試題共四題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Heat is flowing through an annular wall of inside radius  $r_0$  and outside radius  $r_1$ . The thermal conductivity varies linearly with temperature from  $k_0$  at  $T_0$  to  $k_1$  at  $T_1$ . Develop an expression for the heat flow through the wall. (20 分)

Temperature profile in an annual wall.



2. A Newtonian fluid is in laminar flow in a narrow slit formed by two parallel walls a distance  $2B$  apart. It is understood that  $B \ll W$ , so that "edge effects" are unimportant. Make a differential momentum balance, and obtain the following expressions for the momentum-flux and velocity distribution. ( $p_0$ : inlet fluid pressure,  $p_L$ : outlet fluid pressure) (15 分)



$$\tau_{xz} = \left( \frac{\mathcal{P}_0 - \mathcal{P}_L}{L} \right) x$$

$$v_z = \frac{(\mathcal{P}_0 - \mathcal{P}_L) B^2}{2\mu L} \left[ 1 - \left( \frac{x}{B} \right)^2 \right]$$

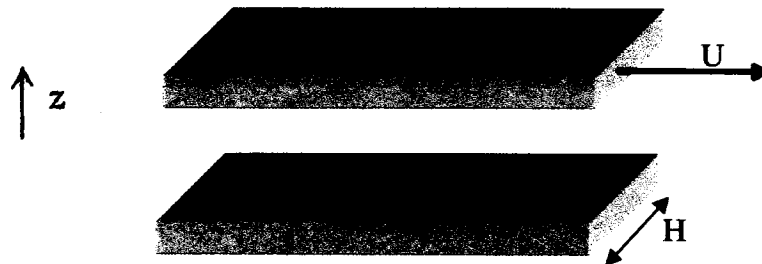
In these expressions  $\mathcal{P}_0 = p_0 + \rho g h = p_0 - \rho g z$ .

$$\mathcal{P}_L = p_L + \rho g h = p_L - \rho g z.$$

3. The “no-slip” boundary condition is typically assumed for most problems in momentum transport. However, if slip should occur, we suggest that the following boundary condition be used:

$$v \Big|_{\text{wall}} = U + \beta \left[ \frac{dv}{dz} \right] \Big|_{\text{wall}}$$

Where  $U$  is the velocity of the wall and  $v$  is the velocity of the fluid. Please apply this boundary condition to the Newtonian Couette Flow between horizontal parallel plates (width,  $H$ ) where the top plate has a velocity  $U$  and the bottom plate is stationary. Please obtain an expression for the velocity profile between the walls (use shell balance approach) (25 分)



4. 單選題 (每一小題 4 分，請依序作答，共 40 分)

- (1) 兩溶液有下列哪一項特性時，無法用蒸餾法將之完全分離? (A)共沸點(B)相同密度 (C)同化學週期(D)相同莫爾數。
- (2) 攪拌槽中設置擋板(Baffle)之目的為何? (A)降低溫度(B)增加渦流(C)增加流體黏度 (D)減少能源。
- (3) 觸媒加速化學反應是利用分子與觸媒表面之何項作用，以降低化學反應發生時之活化能? (A)吸收(B)互溶(C)吸附(D)離子交換。
- (4) 下列何項屬於固液分離之單元操作程序? (A)萃取(B)吸收(C)蒸發(D)過濾。
- (5) 引起流體做自然對流的主要因素為何?(A)密度差(B)電壓差(C)電流差(D)壓力差。
- (6) 蒸餾塔內之溫度分布由下而上之變化為何? (A)遞增(B)遞減(C)不變(D)中間最高。
- (7) 流體化床中填充物之哪一項性質會影響進出口端之壓力差? (A)密度(B)重量(C)孔隙度(D)溫度。
- (8) 兩液體互溶，且其蒸汽壓差異甚大，您認為可用下列哪一種單元操作方式予以分離? (A)蒸餾(B)吸收(C)沉降(D)過濾。
- (9) 白努力定律是利用流體之哪一項性質之差異以產生壓力差? (A)流速(B)透光度(C)吸收波長(D)孔隙度。
- (10) 洗腎是利用哪一項單元操作原理將血液中之毒素去除? (A)沉降(B)離心(C)逆滲透 (D)吸附。