國立成功大學

113學年度碩士班招生考試試題

編　號：117

系　所：工程科學系

科　目：流體力學

日　期：0202

節　次：第 2 節

備　註：可使用計算機

※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

[1.] 名詞解釋，請明確寫出其相關的公式(含定義參數)並清楚說明其物理意義。(a) 雷諾數、(b) 停滯點、(c) 雷諾傳輸定理。(15%)

[2.] Determine the stream function Ψ that yields the velocity field $\vec{V} = 2y(2x+1)\hat{i} + [x(x+1) - 2y^2]\hat{j}$. (10%)

[3.] A rectangular container of water undergoes constant acceleration down an incline shown in Fig. 1. Determine the slope of the free surface using the coordinate system shown in Fig. 1. (15%)
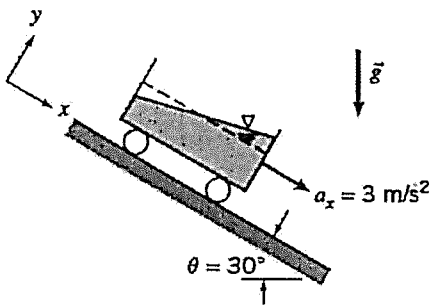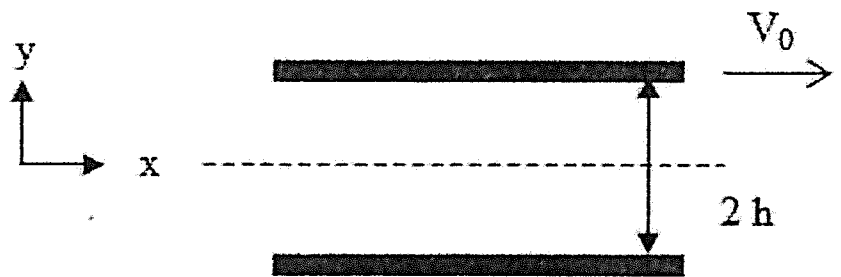

Fig. 1

Fig. 2

[4.] There is a fully developed laminar flow of an incompressible between two infinite parallel plates separated by a distance $2h$ as shown in Fig 2. The top plate moves with a velocity V_0 and there is a negative pressure gradient dp/dx (pressure decreases in the x-direction). Derive an expression for the velocity profile. Determine the pressure gradient and the rate of rotation for which the flow rate is zero. (25%)

[5.] A set of turning vanes for a water system are being designed as shown in Fig. 3. Data have been taken on the pressure drop as a function of the inlet velocity for two different sizes of vanes as given in the table. The water flow was at 20 C and atmospheric pressure for the tests.

V (m/s)	0.5	1	1.5	2	0.5	1	1.5	2
L (m)	0.15	0.15	0.15	0.15	0.3	0.3	0.3	0.3
Δp (Pa)	62	175	540	1175	41	300	910	2100

The governing dimensionless groups are the Reynolds number based on vane length and the Euler or pressure coefficient. (a) Determine values for the dimensionless groups for these data and plot the pressure coefficient as a function of the Reynolds number on log-log coordinates. (b) Fit the data to the form n $C_P = C \cdot Re^n$. (c) Determine the pressure drop for a vane 0.2 m long at a velocity of 1.25 m/s. (25%)
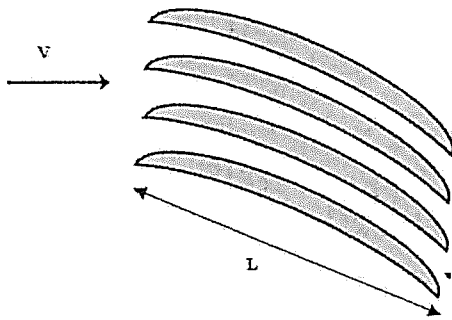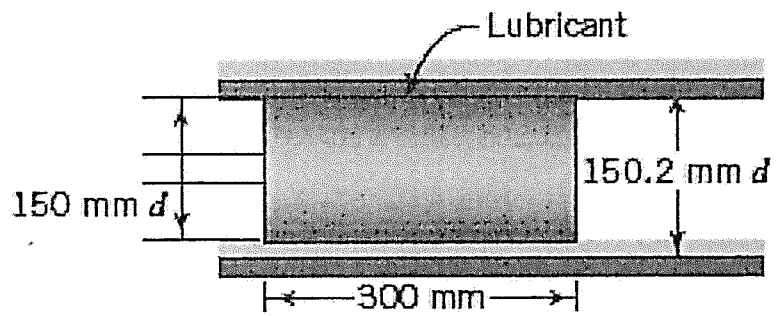

Fig. 3

Fig. 4

[6.] The lubricant has a kinematic viscosity of 2.8×10^{-5} m^2/s and SG of 0.92. The piston (shown in Fig. 4) has a diameter of 150 mm and moves inside a cylinder with the diameter of 150.2 mm. If the mean velocity of the piston is 6 m/s, determine the power dissipated by viscous friction. (10%)