編號： 122

國立成功大學 106 學年度碩士班招生考試試題

系　　所：工程科學系

考試科目：流體力學

考試日期：0214，節次：2

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

[1] (16%)是非題：共 8 小題，答案為(O)或(X)，如果答案為(X)，請給予正確詳細描述，否則不予計分。

(a)流體力學(fluid mechanics)只包含流體動力學(fluid dynamics)。

(b)流體流過一機翼產生升力與阻力，其兩力內積不為零。流體方向與升力方向通常互相平行。

(c)流體壓力(pressure)可視為一種力(force)。

(d)流體黏滯性是因為流體分子間摩擦力所引起。

(e)皮托管(Pitot probe)是在單位時間測量流經管內流量來測定流體速度。

(f)雷諾數是流體慣性力與重力之比值。

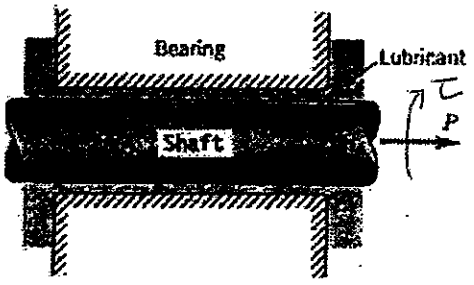
(g)福祿數是流體壓力與剪力之比值。

(h)流體統御方程式為連續方程式及白努力方程式，僅用來計算流體速度(u, v, w)。

[2] (10%)在 2D 流線座標系統(Streamline coordinate)，已知沿著某一流線流體顆粒速度為$\boldsymbol{v} = V\hat{\boldsymbol{s}}$，請導出該顆粒加速度$\boldsymbol{a} = V\partial V/\partial s\,\hat{\boldsymbol{s}} + V^2/R\,\hat{\boldsymbol{n}}$。($\hat{\boldsymbol{s}}$和$\hat{\boldsymbol{n}}$為分別平行和垂直流線之單位向量、R是某一流線之曲率半徑)

[3] (24%) State and explain the Reynolds transport theorem and its application to the conservation of mass and momentum. **(Note, define clearly all the variables and state clearly the assumptions you need to make)**

[4] (15%) A shaft (diameter: D) is pulled through a cylindrical bearing (width: L) as shown in the following figure. The lubricant that fills the gap (length: B) between the shaft and bearing is an oil having a viscosity (μ). (a) Determine the force P required to pull the shaft at a velocity (V). (b) Determine the torque τ required to rotate the shaft at an angular velocity (Ω). Assume the velocity distribution in the gap is linear.



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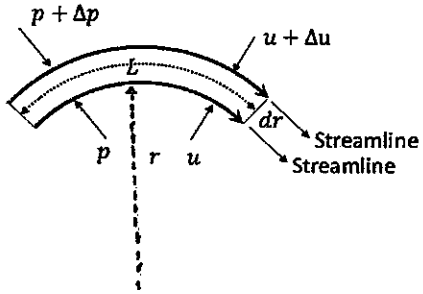
[5] (15%) Derive an expression for the variation of total head across the streamlines of a rotating liquid. **(Note, define clearly all the variables and state clearly the assumptions you need to make.)**



[6] (20%) Derive expressions for the velocity distribution, total flow and film thickness of a Newtonian liquid flowing under gravity down on s surface inclined at an angle of θ to the horizontal. Assume that the flow is laminar and fully developed. **(Note, define clearly all the variables and state clearly the assumptions you need to make.)**