

元智大學 九十七 學年度研究所 碩士班 招生試題卷

系(所)別: 機械工程學系碩  
士班

組別: 甲組

科目: 流體力學

用紙第 1 頁共 1 頁

●不可使用電子計算機

1. 解釋名詞 (各 5%)

- (1) Reynolds number, (2) Euler number  
(3) Mach number, (4) Bernoulli equation  
(5) Navier - Stokes equations  
(6) Viscosity

2. The velocity distribution for laminar flow between parallel plates is given by

$$\frac{u}{u_{\max}} = 1 - \left(\frac{2y}{h}\right)^2$$

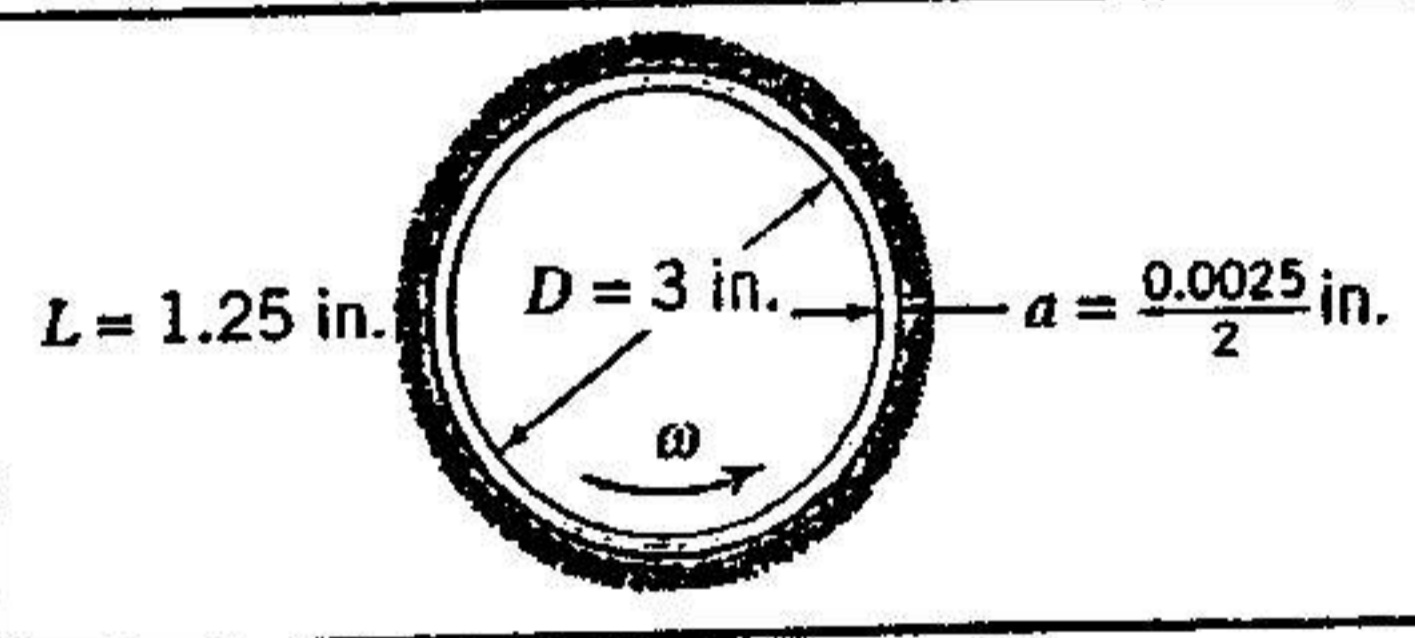
(15%) where  $h$  is the distance separating the plates and the origin is placed midway between the plates. Consider flow of water at  $15^\circ\text{C}$  with maximum speed of  $0.05\text{ m/s}$  and  $h = 5\text{ mm}$ . Calculate the force on a  $0.3\text{ m}^2$  section of the lower plate and give its direction.

$$\mu = 1.2 \cdot 10^{-3} \text{ N}\cdot\text{sec}/\text{m}^2$$

3. Consider the flow field given by  $\vec{V} = ax^2y\hat{i} - byj + cz^2\hat{k}$ , where  $a = 1\text{ m}^{-2}\cdot\text{s}^{-1}$ ,  $b = 3\text{ s}^{-1}$ , and  $c = 2\text{ m}^{-1}\cdot\text{s}^{-1}$ . Determine (a) the number of dimensions of the flow, (b) if it is a possible incompressible flow, and (c) the acceleration of a fluid particle at point  $(x, y, z) = (3, 1, 2)$ .

4. Standard air enters a  $0.3\text{ m}$  diameter duct. The volume flow rate is  $2\text{ m}^3/\text{min}$ . Determine whether the flow is laminar or turbulent. ( $\rho = 1.2\text{ kg}/\text{m}^3$ ) ( $\mu = 1.82 \cdot 10^{-5} \frac{\text{N}\cdot\text{s}}{\text{m}^2}$ )

5. GIVEN: Journal bearing, as shown. Note that the gap width,  $a$ , is half the diametral clearance. Lubricant is SAE 30 oil at  $210^\circ\text{F}$ . Speed is  $3600\text{ rpm}$ .



(20%) FIND: (a) Torque,  $T$ ;  
(b) Power dissipated.

$$\mu_{oil} = 2 \cdot 10^{-4} \frac{\text{lb}\cdot\text{s}}{\text{ft}^2}$$

6. State the convention for designating the nine components of the stress field.

(10%)