

淡江大學 103 學年度日間部轉學生招生考試試題

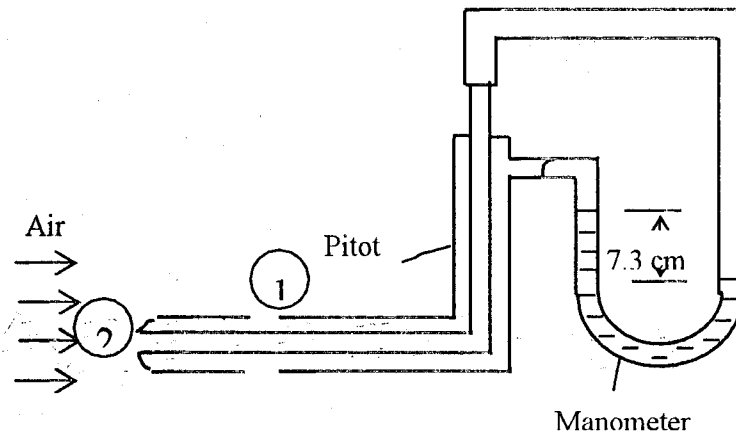
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系別：航空太空工程學系三年級 科目：流體力學

考試日期：7月20日(星期日) 第3節

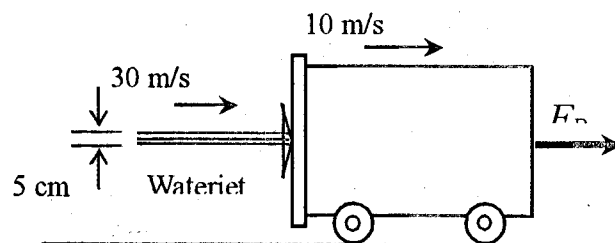
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1. (20) A Pitot-static probe connected to a water manometer is used to measure the velocity of air. If the deflection (the vertical distance between the fluid levels in the two arms) is 7.3 cm, determine the air velocity. (Take the density of air to be 1.25 kg/m^3 .)



Hint:
$$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + z_2$$

2. (20) A 5-cm-diameter horizontal jet of water a velocity of 30 m/s relative to the ground strikes a flat plate that is moving in the same direction as the jet at the velocity 10 m/s. The water splatters in all directions in the plane of the plate. How much force does the water stream exert on the plate?



Hints:

(1) $\dot{m}_r = \rho V_r A$

(2)
$$\sum \vec{F} = \sum_{\text{out}} \beta \dot{m} \vec{V} - \sum_{\text{in}} \beta \dot{m} \vec{V}$$

3. (20) The drag characteristics of a blimp (小型軟式飛艇) 5 m in diameter and 60 m long are to be studied in a wind tunnel. If the speed of the blimp through still air is 10 m/s, and if a 1/10 scale model is to be tested, what airspeed in the wind tunnel is needed for dynamically similar conditions? Assume the same air pressure and temperature for both model and prototype.

本試題雙面印刷

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49-2

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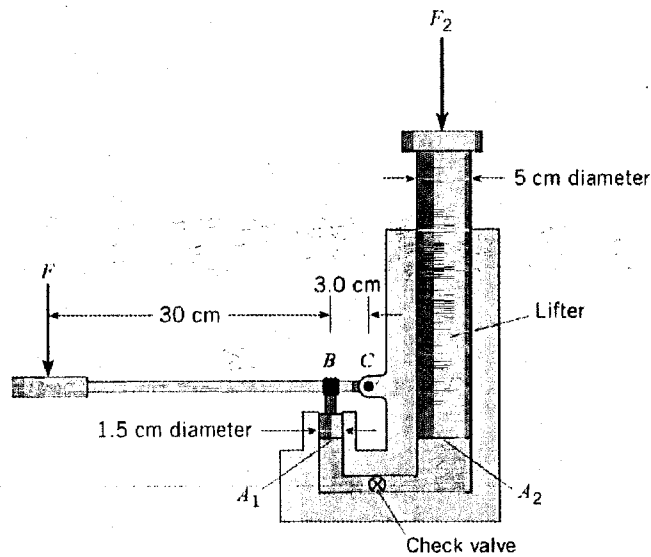
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$$Re_m = Re_p$$

$$\frac{V_m L_m}{\nu_m} = \frac{V_p L_p}{\nu_p}$$

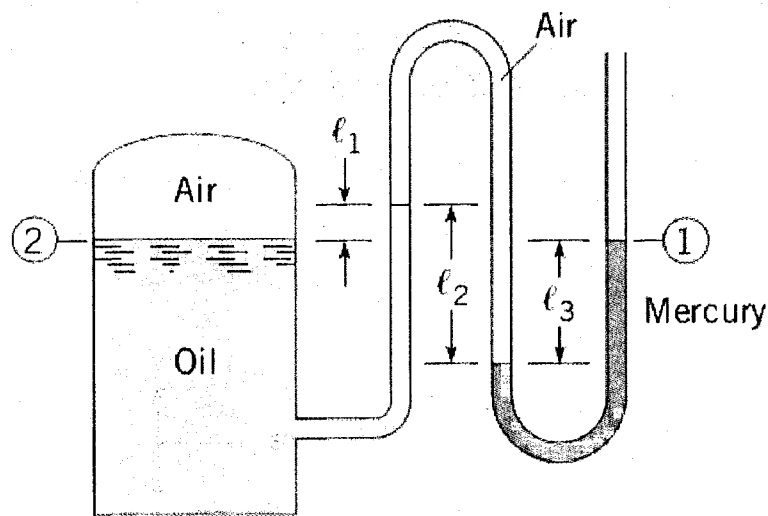
Hints:

4. (10) A hydraulic jack has the dimensions shown. If one exerts a force F of 100 N on the handle of the jack, what load, F_2 , can the jack support? Neglect lifter weight.



$$\frac{F_2}{F_1} = \frac{A_2}{A_1}$$

5. (15) What is the pressure of the air in the tank if $L_1=40$ cm, $L_2=100$ cm, and $L_3=80$ cm? (Density of water= 1000 kg/m³, $SG_{air}=0.0013$, $SG_{oil}=0.8$, $SG_{mercury}=13.6$)



($S = 0.8$)

6. (15) A steady, 2D, incompressible flow field in the xy -plane has the following stream function: $\psi = ax^2 + bxy + cy^2$, where a, b , and c are constants. (a) Obtain expressions for velocity components u and v , (b) Verify that the flow field satisfies the incompressible continuity equation.

$$u = \frac{\partial \psi}{\partial y} \quad \text{and} \quad v = -\frac{\partial \psi}{\partial x}$$

Hint: