

淡江大學 105 學年度日間部寒假轉學生招生考試試題

系別：航空太空工程學系三年級

科目：流體力學

34-1

考試日期：12月3日(星期六) 第2節

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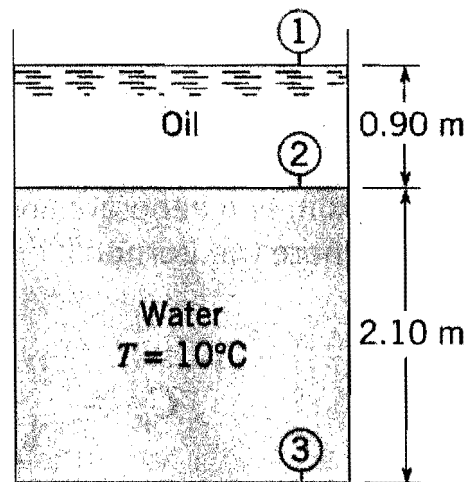
本試題係由印刷

簡答題：(每題 8 分)

1. What is the Eulerian description of fluid motion? How does it differ from the Lagrangian description?
2. What is the definition of the material derivative? Explain.
3. What is the definition of a streamline? What do streamlines indicate?
4. Explain the relationship between vorticity and rotationality.
5. What is the no-slip condition? What causes it?

計算題

6. (10) Oil with a specific gravity of 0.80 forms a layer 0.90 m deep in an open tank that is otherwise filled with water. The total depth of water and oil is 3 m. What is the gage pressure at the bottom of the tank? (Oil (10°C), $S=0.8$, Water (10°C) $\gamma = 9810 \text{ N/m}^3$)



7. (15) Water at 10°C is the fluid in the pipe of Figure below, and mercury is the manometer fluid. If the deflection is 60 cm and L is 180 cm, what is the gage pressure at the center of the pipe? (Water (10°C) $\gamma = 9810 \text{ N/m}^3$, Mercury $\gamma = 133000 \text{ N/m}^3$)

背面尚有試題

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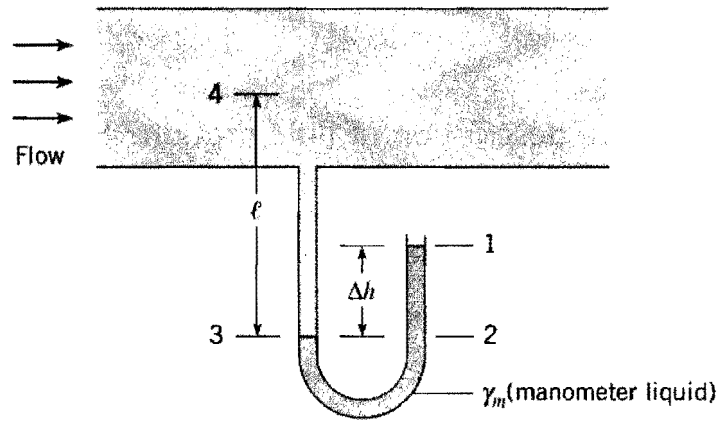
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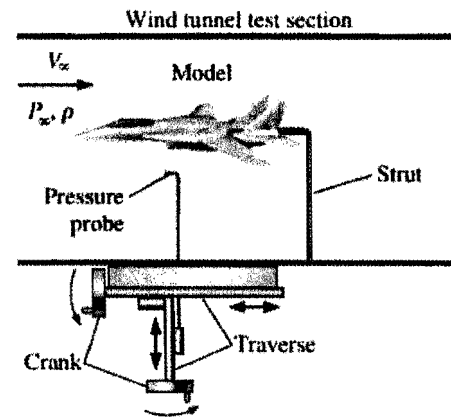
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8. (20) A wind tunnel is used to measure the pressure distribution in the airflow over an airplane model. The air speed in the wind tunnel satisfied incompressible flow assumption. Far away from the model, the air flows at speed V_∞ and pressure P_∞ and air density ρ is approximately constant. Gravitational effects are generally negligible in air-flows, so we write the Bernoulli equation as



$$P + \frac{1}{2} \rho V^2 = P_\infty + \frac{1}{2} \rho V_\infty^2$$

Nondimensionalize the equation, and generate an expression for the pressure coefficient C_p at any point in the flow where the Bernoulli equation is valid. C_p is defined as

$$C_p = \frac{P - P_\infty}{\frac{1}{2} \rho V_\infty^2}$$

Hint: We non-dimensionalize the equation by dividing each term by the dynamic pressure,

$$\frac{1}{2} \rho V_\infty^2$$

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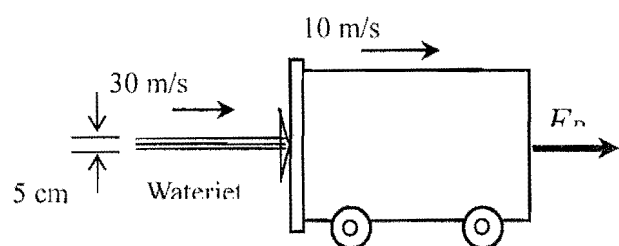
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9. (15) A 5-cm-diameter horizontal jet of water a velocity of 30m/s relative to the ground strikes a flat plate that is moving in the same direction as the jet at the velocity 10 m/s. The water splatters in all directions in the plane of the plate.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



Hints:

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

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