



Prince of Songkla University
Faculty of Engineering

Final Test
10 October 2006
215-342 Mechanics of Fluids II

Semester 1/2549
9:00-12:00
Room R201

Name _____ ID _____

Direction:

1. All types of calculators, and dictionary are permitted.
2. There are totally 5 problems, 9 pages. Solve them all!!
3. One sheet of self-written A4 paper is allowed. No photocopy!

Perapong Tekasakul
Chukiat Kooptarnond

Instructors

Problem No.	Full score	Your mark
1	15	
2	10	
3	15	
4	15	
5	20	
Total	75	

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1. Answer all questions as good as you can. Give sufficient detail of your description. (15 points)

1.1 Under what condition that the Bernoulli Equation is applicable? (2 points)

1.2 What is the main reason that an airplane can fly? (2 points)

1.3 Explain the meaning of *Boundary Layer* in detail. (3 points)

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1.4 Explain the meanings of *friction drag* and *pressure drag*. Does the friction drag contribute to the total drag when the flat plate is placed perpendicular to the flow? (2 points)

1.5 Is it necessary that the flow past a symmetrical object will result in a zero lift force? Explain. (2 points)

1.6 Describe the importance of *flaps* during take-off and landing of an airplane. (2 points)

1.7 What is a *Mach Cone*? (2 points)

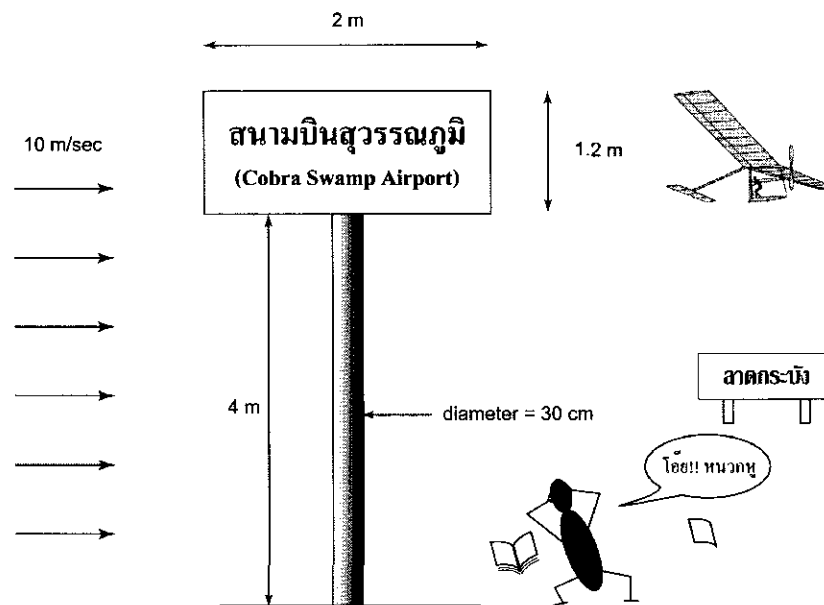
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2. A half-body of a full thickness of 1.0 m is placed in an airstream moving at 15 m/sec. Determine: (10 points)
- the source strength, and
 - the equation of the streamline passing through the stagnation point.

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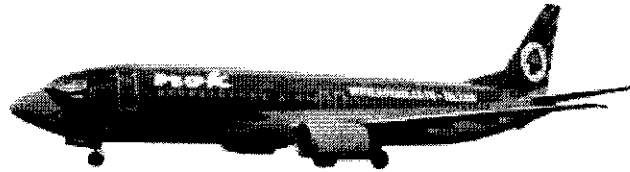
3. Wind speed of 10 m/sec is blowing against the structure shown below. Determine the total drag on this structure. (15 points)

Properties of air at 20°C: $\nu = 1.5 \times 10^{-5} \text{ m}^2/\text{sec}$, and $\rho = 1.2 \text{ kg/m}^3$



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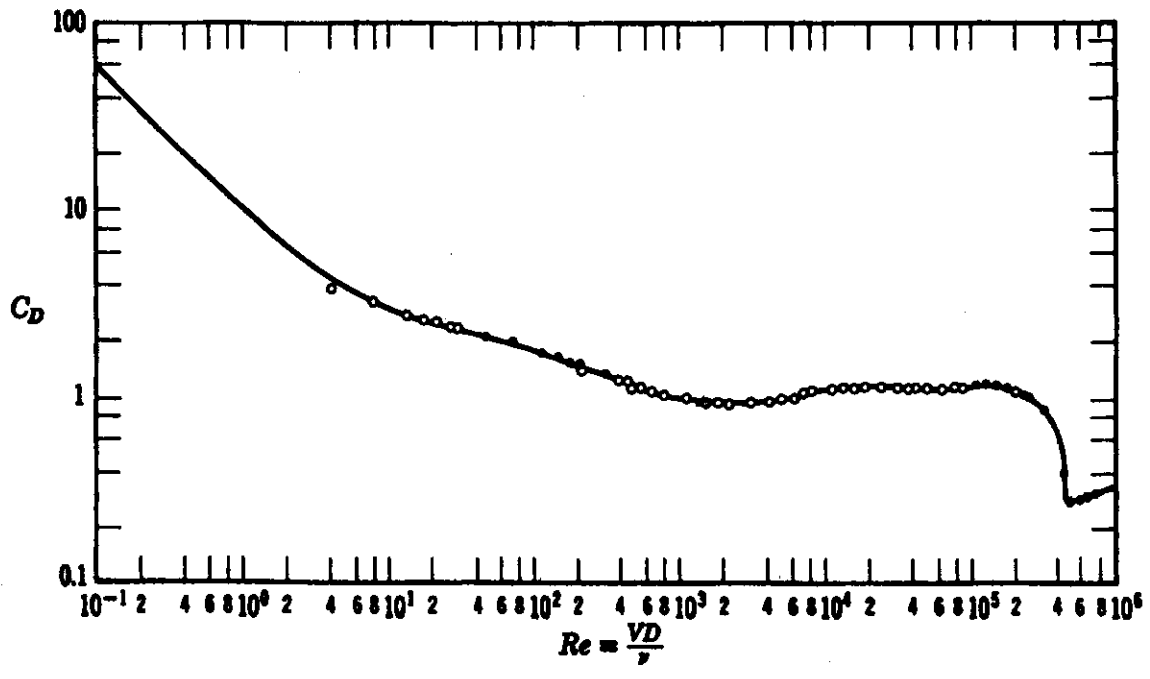
4. A Boeing-737 aircraft operated by Nok Air weighing 400,000 lbf when carrying 250 passengers from Bangkok to Pooget takes off with an airspeed of 120 mph from the Don Muang Airport during the last-day operation of the airport. The same aircraft carrying only 20 passengers from Bangkok to Hat Yai. Determine the take-off speed of this aircraft assuming that the average weight of Thai people is 140 lbf. Note that the decrease of passengers to Hat Yai results from the recent terrorism attack in the city center. (15 points)



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5. Helium at 68°F and 14.7 psia (standard atmospheric condition) in a large tank flows steadily and isentropically through a converging nozzle to a receiver pipe. The cross-section area of the throat of the converging nozzle passage is 0.05 ft². Determine the mass flow rate through the duct if the receiver pressure is 10 psia and sketch the temperature-entropy diagram. Assume $k = 1.66$, and $R = 1.242 \times 10^4$ lbf-ft/(slug °R). (20 points)

Drag coefficient for a cylinder of diameter D



Scratch paper - You can remove this section from the test sheets.