Prince of Songkla University
Faculty of Engineering

Final Test
11 October 2005
215-342 Mechanics of Fluids II

Semester 1/2548
9:00-12:00
Room _____

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	**20**	
2	**15**	
3	**15**	
4	**15**	
5	**20**	
Total	**85**	

Name _____ ID _____

215-342 – Mechanics of Fluids II
Final Test
Semester 1/2548

1. Answer all questions as good as you can. Give sufficient detail of your description. (20 points)

1.1 What is the difference between *Inviscid* and *Viscous* flow? Give example of actual flow that can be approximated inviscid flow. (4 points)

1.2 What type of inviscid flow simulates the tornado? Draw its flownet. (3 points)

1.3 Describe the boundary layer separation phenomenon. (2 points)

Name _____ ID _____

1.4 Explain 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? (3 points)

1.5 Is it necessary that the flow past a symmetrical object will result in a zero lift force? Explain. (3 points)

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

1.7 A plane flying at the altitudes of 1 km and 10 km with the same velocity. Should the Mach number be the same? Why? (3 points)

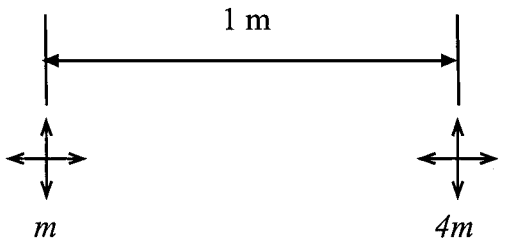
Name _____ ID _____

2. Following is an email message from Jod Push to Tuxin. Suppose you are Tuxin, help Jod Push out with his problem. (15 points)

```
Subject: Need Help
Date: Thu, 4 Oct 2005 11:54:10 +0700
From: "Jod Push" <push@greyhouse.bagdad.iraq>
To: "Tuxin Shinsha" <tuxin.s@myhome.whocares.mycountry>

Hi Maew!

How are you doing?  I haven't heard from you since you
blasted those jerks at the You En.  Great Job!  You know.  I
have some problem to ask you.  My son is in the Engineering
school now.  His teacher assigned him a homework.  You know
what!  He asked me how to solve the problem!  My god, I don't
even know how to start it.  I then thought of you.  You're a
smart guy.  You helped me out with a lot of homeworks.  Could
you please help me one more time.  I don't want my son to
know that I am stupid.  The problem is attached.

Thanks a million,
Good old Jod.
```

Attached: jodcouldnotsolve.jpg

Homework 1: Two sources, one of strength m and the other with strength $4m$, are located at the distance 1 m apart, as shown. Determine the location of the stagnation point in the flow produced by these sources.

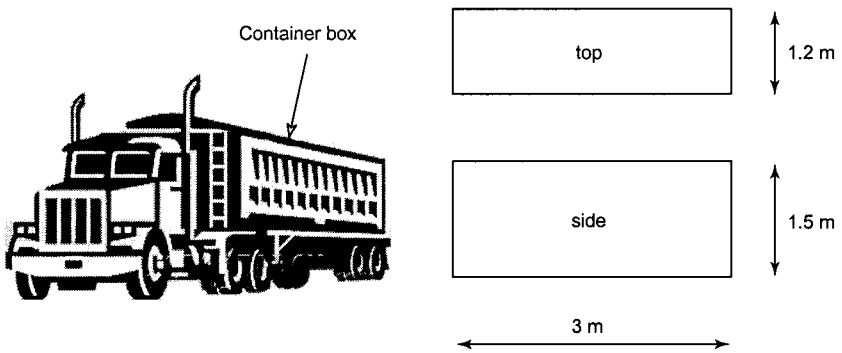


Name _____ ID _____

Name _____ ID _____

3. A trailer truck is transporting commercial goods from the warehouse in Bangkok to Big B in Tak Bai. During the journey from Surat Thani to Tungsong, the driver drives the truck at the constant speed of 100 km/hr. Determine the overall drag forces on both sides and a top surface of the container box with the dimension shown below? (15 points)

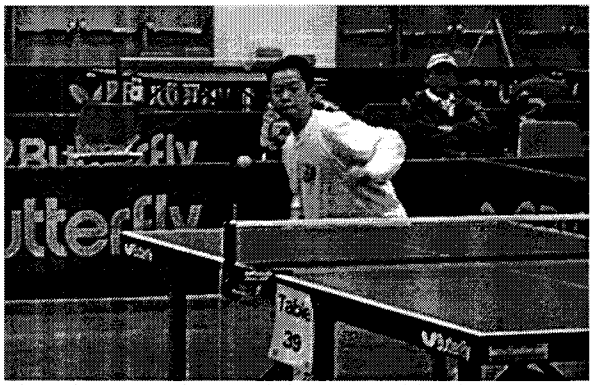
Properties of air at 20°C: $\nu = 1.5\times10^{-5}$ m^2/sec, and $\rho = 1.2$ kg/m^3



Name _____ ID _____

4. During the World Table Tennis Championship 2005, Ah Tee hits the ball so hard that it travels at the speed of 15 m/sec as it leaves the paddle. Assume the table tennis ball with diameter 38 mm weigh 2.40 g, determine (15 points)
   (a) the drag force on the ball.
   (b) the speed that the ball leaves the paddle so that the drag coefficient is minimized and the drag force at this speed, and
   (c) the deceleration of the ball.

   Use the air properties as in Problem 3.



Ah Tee is concentrating at the ball. Photograph by Ah Goo+.

Name _____ ID _____

5. Air flow steadily and isentropically from standard atmospheric conditions to a receiver pipe through a converging duct. the cross section area of the throat of the converging duct is 45 cm^2. Determine the mass flow rate through the duct if the receiver pressure is 40 kPa and sketch the temperature-entropy diagram. Assume $\rho_0 = 1.2$ kg/m^3, $p_0 = 101$ kPa, $T_0 = 15°C$ and $R = 287$ J/kg K. (20 points)

Drag coefficient for spheres