13.012 Hydrodynamics for Ocean Engineers
Course Information
Fall 2004

Professor Alexandra H. Techet
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Lectures: T/Th 1:00-2:30 AM; Room 1-371
Labs: F9-11; Various OE Labs
Course Webpage: http://web.mit.edu/13.012/www/

Teaching Assistant: Kai McDonald
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Office: 5-331; Lab: 5-008

Prereq.: 13.015J or 2.003 (or permission of instructor)
U (Fall)
Units: 4-1-7

This course introduces the principles of fluid mechanics and applies them to practical ocean engineering problems. The fundamental properties of a fluid are investigated and the basic governing equations of fluid motion are derived in differential and integral form. Hydrostatic equations and vessel stability are discussed in the context of surface and underwater vessels. Basic flows past cylinders, spheres, flat plates and hydrofoils are used as a platform for understanding the more complex flows often found in ocean engineering and naval architecture applications.

Topics include the principles of conservation of mass, momentum and energy; hydrostatic behavior of floating and submerged bodies; lift and drag forces; dimensional analysis; wave forces on ships and offshore platforms; laminar and turbulent flows.

Experimental projects will be conducted in ocean engineering laboratories illustrating concepts taught in class, including ship resistance and model testing, lift and drag forces on submerged bodies, and vehicle propulsion. Weekly lab sessions will be supplemented by practical problem sessions and demonstrations. Lab sessions are geared towards demonstrating proper data collection and analysis as well as writing clear and concise lab reports. Statistical data analysis, time series analysis and error estimation will be discussed in the context of each lab.
Course Organization:

Weekly problem sets will be assigned and are due the following week unless otherwise noted. **Homework solutions are expected to be the result of individual effort.** However, group discussions of the concepts covered on the homework and review of the course material is encouraged.

Laboratory projects and reports should also be done individually. While the data will be the result of a collective effort, the final processing and analysis should be done individually unless otherwise noted. Lab assignments will be due on the date specified on the lab hand-out. Pre-lab exercises should be done prior to coming to class and can be done collectively.

There will be two quizzes administered in class and a final exam scheduled during exam week. Partial credit will be given on all problems, except multiple choice and fill in the blank type questions.

Grading Policy:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework</td>
<td>15%</td>
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<tr>
<td>Laboratory</td>
<td>20%</td>
</tr>
<tr>
<td>2 In-class Exams</td>
<td>30%</td>
</tr>
<tr>
<td>Final Exam (closed book)</td>
<td>35%</td>
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Exceptional performance on one aspect can help even out a rocky performance on another. The two mid-term exams will be administered in class; these exams will be closed book. One double-sided sheet of notes will be allowed for the final exam, which is otherwise a closed book exam.

Course Webpage:

A course webpage will be maintained at:


Homework assignments, lab exercises, and class handouts will be posted. Solutions to homework will be handed out in class. Lab data will be posted on the site so that it can be accessed remotely.

In order to retrieve all handouts Adobe Acrobat reader will be required.
Text for the Course:


The text is available at the MIT Coop in Kendall Sq. or at Barnes and Noble’s web page (www.bn.com) or Amazon.com. A copy is also on reserve at Barker Library.

If anyone has trouble obtaining the text please contact the instructor.

Recommended Reading:

“Fluid Mechanics for Ocean Engineers” By T. Francis Ogilvie, Dept. of Ocean Engineering, 13.012 Course Notes. (If you do not have a copy and would like one please contact the instructor).


Additional Texts that can be insightful:

“Fluid Flow”, By Sabersky, Acosta, Hauptman, Gates. (on reserve for 13.021)

“Fluid Mechanics”, By F.White (McGraw-Hill) (on Reserve)