

13.42 DESIGN PRINCIPLES FOR OCEAN VEHICLES

Spring 2005

Tuesdays and Thursdays 9:30 am - 11:00, in 5-234

<http://web.mit.edu/13.42/www/>

Instructor Information:

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Course Description:

The course will cover the basic techniques for evaluating the maximum forces and loads over the life of a marine structure or vehicle, so as to be able to design its basic configuration. Loads and motions of small and large structures and their short-term and long-term statistics will be studied in detail and many applications will be presented in class and studied in homework and laboratory sessions. Issues related to seakeeping of ships will be studied in detail. The basic equations and issues of maneuvering will be introduced at the end of the course.

Three laboratory sessions will demonstrate the phenomena studied and provide experience with experimental methods and data processing.

Course Outline:

- Introduction to Course
- Dynamical Systems

Part I: Tools for Seakeeping Analysis

- Linear Time Invariant (LTI) systems analysis
- Fourier Transform and LTI Systems
- Random Processes and Linear systems
- Power Spectral Density
- Short Term Statistics
- Waves and Wave Spectra
- Long Term Statistics

Part II: Fluid Structure Interactions

- Viscous forces
- Drag and Resistance of streamline and bluff bodies
- Vortex induced vibrations

- Flow instabilities and galloping
- Vortex induced forces and motions

Part III: Seakeeping and Station Keeping

- Forces on small structures
- Forces on large structures-McCamy and Fuchs theory
- Linear theory of wave forces and motions
- Radiation and diffraction forces
- Second order forces and moments–Added Resistance

Grading:

There will be Two (2) in-class (1.5 hour) exams, weekly homeworks, two laboratories and a final project. The exams will be open book/open note exams. The grades for the course will be based on the following:

- (1) 50% on the two quizzes
- (2) 35% on the labs/projects
- (3) 15% on the homeworks

Individual Work:

Each student will work individually on the homeworks, projects, and quizzes.

Useful References:

There is no required text for this class. In the past students have found the following text useful:

- ◇ O. M. Faltinsen (1993) *Sea Loads on Ships and Offshore Structures*, Cambridge University Press (paperback edition).
- ◇ Additional supplemental readings will be suggested throughout the term.

Reading assignments (lecture notes) will be posted on the course website in electronic (PDF) form along with all overhead slides.

Course Website

Lecture notes, supplemental notes, course information, problem sets and lab assignments will be placed on the web at “<http://web.mit.edu/13.42/www/>”. These PDF files are served through the web.mit.edu site.