Fall 2015

NAME 3120

Christine Ikeda
University of New Orleans

THE UNIVERSITY of NEW ORLEANS
School of Naval Architecture and Marine Engineering • College of Engineering
Christine Ikeda, PhD • E-mail cikeda@uno.edu • Phone 504 280 7184 • Room EN 934

NAME 3120 Fall 2015

Ship Hull Strength

Course Description

This course provides an introduction to analysis and design of ship structures. The primary focus of this class is to understand longitudinal strength of ships, types of loading, types of failure, how to mechanically model (generate a free-body diagram) for a given loading situation, and finally, advanced methods for dealing with statically indeterminate beams. In addition, the following topics will be introduced: torsional strength, classification society rules and buckling. Prerequisites include a "C" or higher in the following: MATH 2134/2115 (Multivariable Calculus), MATH 2221 (Ordinary Differential Equations), ENCE 2351 (Mechanics of Materials), and NAME 2160 (Hydrostatics and Stability).

Class

Class time: Monday, Wednesday 2:00pm – 3:15pm, Room EN 319
Punctual attendance is ***MANDATORY*** at every class and will be monitored.

Instructor

Instructor: Christine Ikeda, PhD
Assistant Professor of NAME
E-mail: cikeda@uno.edu
Twitter: @Prof_Ikeda_UNO
Office: EN 934
Phone: (504) 280-7184

Office hours:

Monday	3:15pm – 5:15pm
Tuesday	2:00 – 4:00pm
Wednesday	10:00am – 12:00pm

Tentative Schedule
Or by appointment.
Please avoid the hour directly before class.

Grading

The final course grade will be based on the total number of points scored during the term. With averages of 90%, 80%, 70%, you are guaranteed an "A," "B," or "C," respectively. Grades will not be curved. The contributions are weighted as shown on the right.

Homework:	5%,	5 pts ea.
Quizzes:	10%,	10 pts ea.
Labs:	10%,	35 pts ea.
Project:	10%,	70 pts tot.
Exam 1:	20%,	140 pts
Exam 2:	20%,	140 pts
Final Exam:	25%,	175 pts

At the start of the semester, each student will receive 2 bonus points. Any absence (includes tardiness and being asked to leave for using a cell phone) regardless of the reason will result in a 1 point decrease in your grade.

Select the grade you want at the beginning of the semester and work toward **earning** that grade throughout the semester.

Exams

There will be two midterm exams and a final exam (Thursday, December 10, 2015 from 3:00pm – 5:00pm). Exams will have a close-note (25% theory) and open-note (75% problem solving and theory) component, and you will be informed the expectations prior to the exam time.

Learning Outcomes

1. Create and solve mathematical models for ship structural components and realistic loading conditions.
2. Understand basic fundamental principles of ship structural analysis.
3. Be able to solve non-conventional problems, i.e., spec out the size of a component required to meet a certain design requirement.
4. Select some scantlings based on classification rules and understand from where these rules are derived. Note: This is NOT a class on ABS rules.
5. Design a midship section based on the bending of the hull girder.
6. Develop a basic understanding of torsion, shearing, and buckling.

Course Topics

In order to achieve these learning outcomes, the following topics will be covered

- Hull Girder Bending: Stillwater Loading and Wave Loading Approximations
- Mechanical Modeling and Boundary Conditions
- Statically Indeterminate Beams
  - Superposition Method
  - Moment Distribution Method
- Shear Force and Shear Flow (Introductory level)
- Torsion in Ship Hulls (Introductory level)
- Column and Panel Buckling (Introductory level)
- Introduction to Finite Element Analysis
- Introduction to Welding

Textbook/References

The following references are suggested, but not required:

P. Miller (2014). *EN358 Ship Structures: Notes for an Undergraduate Course.* United States Naval Academy Reader. *Excerpts will be provided.*

A. Mansour and D. Liu (2008). *Strength of ships and ocean structures.* J.R. Paulling (Ed.), *The Principles of Naval Architecture Series.* Society of Naval Architecture and Marine Engineers (SNAME).

O.F. Hughes (1983). *Ship structural design – A rationally based, computer-aided, optimization approach.* John Wiley & Sons.

D.J. Eyres (2001). *Ship construction.* Butterworth-Heinemann, 5th edition.

T. Lamb (Ed.) (2003). *Ship design and construction I+II.* Society of Naval Architecture and Marine Engineers (SNAME).

Student Conduct and Professionalism

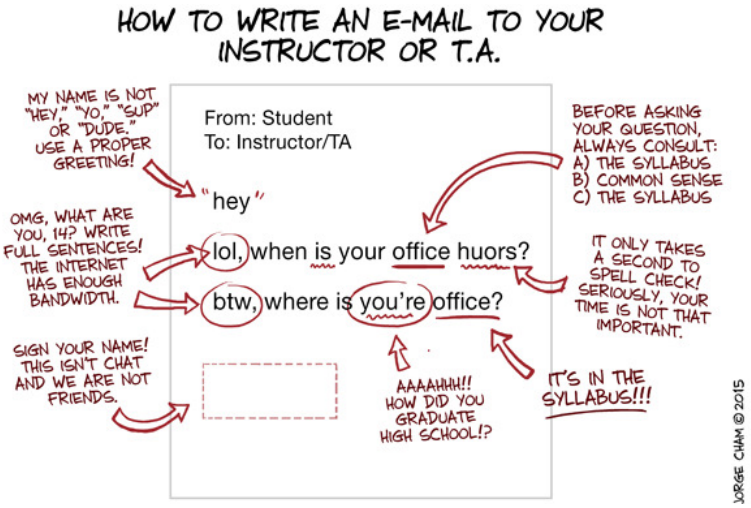
College is a transition from childhood to a professional-working environment. This class is a major requirement toward your Naval Architecture/Marine Engineering degree. I expect to treat you as I would treat employees working for me, and I expect that you will treat me as you would treat your boss or customer. Remember to use professionalism in all communications (conversation, class, e-mail, etc.).

Classes will be taught in an interactive manner, and your attendance at every class session is important and required. Attendance means that you arrive on time to class and stay until the class is dismissed. No cell phones are to be used during class time. Any student caught using a cell phone in class will be asked to leave and will receive an absence (deduction of one point) for that class period.

Questions are encouraged during class and outside of class. When asking a question, please **ask** a specific question. "I cannot do number 4." is not a question, nor is it specific. Explain to me what you have done to answer your own question (i.e., "I consulted my class notes and searched online," or "I tried using the Euler buckling equation."). State anything you know (i.e., "I know that to use the Euler buckling equation, I must assume that my stanchion is slender"). Tell me what you think the answer should be and ask for confirmation. Any question that is not specific will most likely require a back-and-forth dialog that involves disclosing the information listed above. These non-specific questions may not be answered quickly due to an answer not being readily available and may need to be asked again. Please use your time and my time efficiently.

Every person and professor has their own policy for replying to emails. Due to my other responsibilities, I not always reply to emails immediately. My policy is to reply to student emails within one business day. Please note: the more specific your question, the more likely you will receive a timely response.

Please plan ahead, start homework early and ask questions early. Do not expect a response to a question regarding an assignment the night before it is due.



Learning process

Course material will be distributed via the *UNO Moodle* web-site: `https://uno.mrooms3.net/login/index.php`. Assignments and supplemental material will be posted. I will communicate important announcements through your UNO e-mail address.

Academic integrity

Academic integrity is fundamental to the process of learning and evaluating academic performance. Academic dishonesty will not be tolerated. Academic dishonesty includes, but is not limited to: cheating, plagiarism, tampering with academic records and examinations, falsifying identity, and being an accessory to acts of academic dishonesty. Refer to the UNO Judicial Code for further information. The new policy on Academic Dishonesty is available online at `http://www.studentaffairs.uno.edu/policies.cfm`.

Homework and Quizzes

Each week, there will either be a homework assignment due or a quiz. **NOTE:** The quizzes may be announced or unannounced and you will have 10-15 minutes to complete them. The quizzes will often times be similar in scope to the homework and evaluate your understanding of the course material. Deadlines will be specified when homework is assigned and are the last time that your work can be submitted. You are allowed to submit homework before the deadline. **Late homework** even by one minute **will not be accepted for any reason.**

Some homework may require you to get familiar with a spreadsheet program (Excel, etc), writing small programs (Matlab) or using commercial software packages (ANSYS or MAESTRO). Homework is not an exam. If you get stuck or are unsure how to solve a problem consult with your classmates or ask me, but please do your own work so that you are prepared for exams and a real job.

Requirements for all Quizzes, Handwritten Homework, and Exams

- **All assignments will be handwritten in pencil only, on one side of the page only**, and preferably on engineering paper. Write large and clearly. Do NOT copy the problem wording, but provide the following format: **GIVEN, FIND, DIAGRAM, SOLUTION**. See example.
- Your coordinate system MUST be shown for every problem.
- Box your final answer so I can find it. Use a *minimum* of 4 significant figures in all calculations, but round and report your final answers to **3 significant figures**. Give complete answers: magnitude, direction (if necessary) and units. If one of these is missing, you will not receive full credit.
- Be neat and organized. **Use a straight edge and circle template or compass**.
- Draw an arrow over any and all vector quantities to distinguish them from scalar quantities.
- If there are forces in your problem, you must have a free body diagram (FBD). **WITHOUT A FREE BODY DIAGRAM, THE PROBLEM WILL NOT BE GRADED**.
- Pages careless ripped out of a notebook or legal pad will not be accepted. Your homework is a professional document and should be prepared as such.

If your homework does not meet these requirements, it will be returned for rework, but will be left ungraded on a test or quiz!

Semester Project

You will work on a semester project in groups of 3 or 4 students. You will be assigned your groups. The project will help you to understand the assumptions that are made in the analysis you are taught in class and will give you experience in finite element analysis. The project will be broken into three parts due throughout the semester and further details will be distributed later.

- Part 1: Preliminary Report: Hand-calculations of the problem using methods learned in class and discussion of parameters to be tested with the Finite Element Method
- Part 2: Finite Element Analysis: Matlab code with comments due
- Part 3: Final Project Report: Preliminary report revised and results/analysis/conclusions from finite element analysis

Laboratory Assignments

Two laboratory assignments will be assigned this semester. All assignments will be conducted outside of class time. Appropriate attire for all laboratories will be strictly enforced, especially for the shipyard tour.

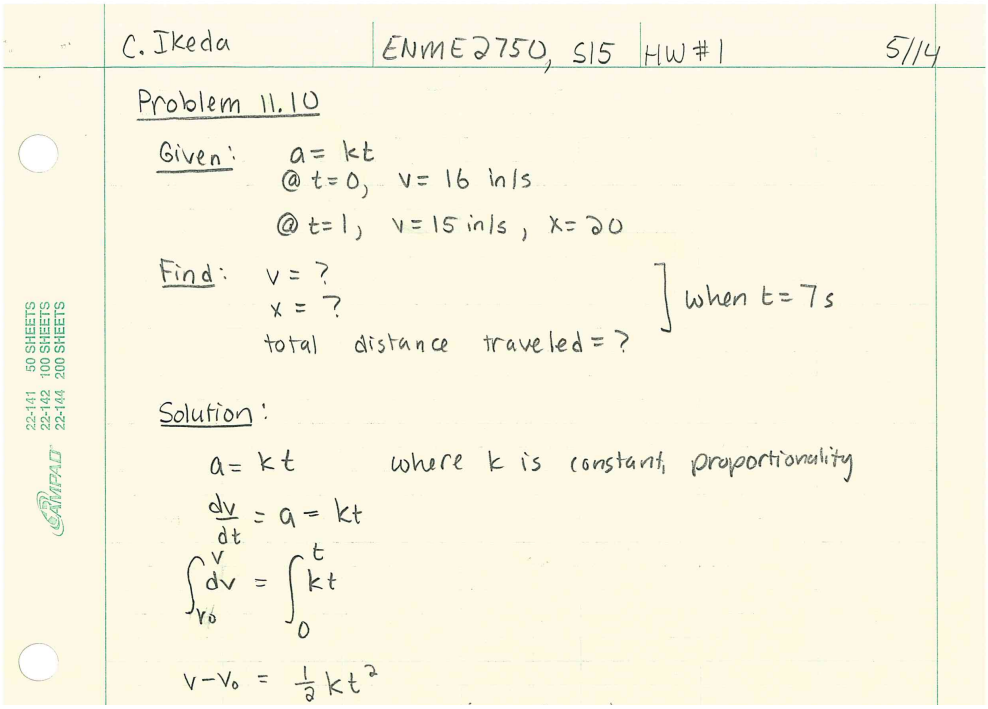
Laboratory 1 is the shipyard tour. Two dates and times are available and you must attend one. You must arrive on time and stay for the duration of the entire tour (I will be attending both tours and I will monitor attendance and participation). Further details about the lab report and the grading of this assignment will be distributed later (Note: it is 5% of your final grade in this class). Transportation will not be provided but carpooling is encouraged. Both shipyards are an hour to an hour and a half drive from UNO. Long pants and closed toe shoes are required (people with shorts, skirts, flip flops, or sandals will not be able to tour the yard). Steel toe shoes are preferable but not required. Last year each of the tours (once at the Shipyard) took about 2 to 3 hours.

- Saturday, September 19, 2015 at 9am: Gulf Island Fabrications outside of Houma, LA.
- Friday, October 2, 2015 at 1:30pm: Bollinger Shipyards in Lockport, LA.

Laboratory 2 will be conducted at UNO (in EN 210). This lab will be available for 1 week, and students will sign up for a time slot. The assignment will take about an hour to an hour and a half. Details for the lab report requirements, lab instructions and specifics will be distributed later. Tentatively, the assignment is planned for the week of October 5-9, 2015.

Accommodations for students with disabilities

Students who qualify for services will receive the academic modifications for which they are legally entitled. It is the responsibility of the student to register with the Office of Disability Services each semester and follow their procedures for obtaining assistance.


C. Ikeda ENME 2750, S15 HW #1 5/14

Problem 11.10

Given: $a = kt$
@ $t=0$, $v = 16$ in/s
@ $t=1$, $v = 15$ in/s, $x = 20$

Find: $v = ?$
$x = ?$
total distance traveled = ?
] when $t = 7$ s

Solution:

$a = kt$ where k is constant, proportionality

$\frac{dv}{dt} = a = kt$

$\int_{v_0}^{v} dv = \int_{0}^{t} kt$

$v - v_0 = \frac{1}{2} kt^2$

Semester Schedule

Tentative

	Date	Topic	Assigned	Due
W	Aug. 19	Introduction, Mathematics and Statics Review	HW #1	
M	Aug. 24	Mathematics, Statics, Mechanics of Materials Review	Quiz #1	
W	Aug. 26	Mechanics of Materials Review		
M	Aug. 28	Mechanics of Materials Review		
W	Sept. 2	Ship Structural Loads	HW #2	HW #1
M	Sept. 7	Labor Day, No Class	Quiz #2	
T	*Sept. 8*	*Last Day to drop without a "W"*		
W	Sept. 9	Hull Girder Bending: Stillwater Loading		
M	Sept. 14	Hull Girder Bending: Stillwater Loading		
W	Sept. 16	Wave Loading	HW #3	HW#2
S	*Sept. 19*	*9am Gulf Island Shipyard Tour*		
M	Sept. 21	Pure Bending of the Hull Girder		
W	Sept. 23	Section Modulus and Moment of Inertia		HW #3
M	Sept. 28	Special Topic: Composite Beam Bending	HW #4	
W	Sept. 30	Exam #1		
F	*Oct. 2*	*1:30pm Bollinger Shipyard Tour*		
M	Oct. 5	Introduction to Finite Element Analysis: Rods	Lab #2	Lab #1
W	Oct. 7	Finite Element Analysis: Beam Elements	Quiz #3	
M	Oct. 12	Compression Loading on Hull Girder		HW #4
W	Oct. 14	Plate Buckling in Ships		Preliminary Report
		Last Day to Drop Class		
M	Oct. 19	Secondary Loading: Modeling and B.C.'s	HW #5	Lab #2
W	Oct. 21	Secondary Loading: Method of Integration	Quiz #4	
M	Oct. 26	Midship Section Design and Superposition		
W	Oct. 28	Transverse Strength: Superposition	HW #6	HW #5
M	Nov. 2	Transverse Strength: Moment Distribution Method	Quiz #5	
W	Nov. 4	Transverse Strength: Moment Distribution Method		Matlab Code Due
M	Nov. 9	Transverse Strength: Moment Distribution Method		
W	Nov. 11	Introduction to Shear Force and Shear Flow		HW #6
M	Nov. 16	Shear Force and Shear Flow in Ships	Quiz #6	
W	Nov. 18	Introduction to Torsion in Ship Hulls	HW #7	
M	Nov. 23	Exam #2		
W	Nov. 25	Torsion of Non-Circular Rods		Final Project Due
M	Nov. 30	Torsion of Single-Cell Closed Sections	Quiz # 7	
W	Dec. 2	Introduction to Welding		HW #7
Th	Dec. 10	Final Exam		