

Course: EN-4151 APPLIED NAVAL ARCHITECTURE
Credits: 3
Professor: LCDR Trudeau
Semester Spring 2025
Office: Room 216A Harrington

Text: Ship Construction by DJ Eyres 7th Edition

Prerequisite: EN 3112 – Strength of Materials

Student Hours:

Rm 216A Harrington, **1200-1300**, or email me,or stop by anytime.
Office phone: 508-830- 5279 **Email: dtrudeau@maritime.edu**

Grading: This course is an STCW knowledge-based assessment course requiring a minimum grade of C-, or 70%, for the semester grade. In accordance with the Engineering Department STCW grading policy, a *grade lower than 70% receives an F for the course.*

The semester grade will be assigned as follows:

Quizzes & Homework (60%), Mid Term Exam (20%), Final Exam (20%)

Attendance:

Attendance is mandatory for all class lectures. Special liberties **DO NOT COUNT** as an excused absence. Only the Dean can issue an excused absence.

Students with perfect attendance will have their lowest quiz grade dropped.

There will be NO make-up quizzes offered even with an excused absence and NO QUIZZES WILL BE DROPPED. Missing a quiz equals zero.

Students will be allowed two absences from class lectures only. After that 2 points will be deducted from final grade for each absence. Students will have to make-up all required work. If a student misses more than five (5) class he or she will fail the class.

Notes

1. Our disability resource contact is Dr. Elaine Craghead, ABS bldg., rm 320. She may be reached at 508-830-5120 or ADAcpliance@maritime.edu
Students having accommodations need to notify me of them.
2. Cadets attending class will be in the correct classroom uniform.
3. No food or drink is allowed in the classroom
4. Bathroom breaks only in extreme emergency

2Learning Outcomes:

Upon completion of this course, it is expected the Student:

1. Will be able to calculate, or estimate, the area and volume of tanks and other ship shapes.
2. Will have a general knowledge of the principal structural members of a ship.
3. Will be able to explain why a ship floats.
4. Will be able to draw a diagram showing the key parameters involved with measuring a ship's stability.
5. Will be able to explain the effect of load changes on stability.
6. Will be able to use a ship's hydrostatic curves-of-form to obtain displacement and other initial stability information.
7. Can clearly explain how the ship's center of gravity changes when moving weights.
8. Can clearly explain the effect of free surface and be able to calculate the free surface correction if given a ship's loading condition.
9. Will have a working knowledge of the causes and effects of stress on a ship's hull.
10. Will understand what structural hull loads are, and, be able to calculate basic longitudinal hull stress for a simplified loading.
11. Will understand the importance of maintaining watertight integrity.
12. Will be able to estimate a ship's power requirement given speed and resistance data.

STCW Learning Objectives

Demonstrate knowledge and understanding of the following STCW elements:

- OICEW-D2.1 Stability, trim and longitudinal stress
- OICEW-D2.2 The fundamentals of watertight integrity
- OICEW-D2.3 The fundamental actions to be taken in the event of partial loss of intact buoyancy
- OICEW-D2.4 General knowledge of the principal structural members of a ship and the proper names for the various parts
- OICEW-C.1.1 Characteristics and limitations of materials used in construction and repair of ships and equipment

APPLIED NAVAL ARCHITECTURE – Spring 2025 - SYLLABUS

DATE Lesson #	TOPIC	
Lesson #1	Administrative issues. Nomenclature, Finding Areas HW Find Area under curve	HO #1 Basic Measurements
Lesson #2	More nomenclature, dimensions, finding Area, finding Center of area. HW Find Vol of liquid in tank	HO #2A Prop of water HO #2B Find Area and center
Lesson #3	Relationships: Underwater volume, weight, specific weight Sectional area & volume, calculating the weight of a barge	HO #3A Underwater Volume HO #3B Calc barge weight
Lesson #4	Weight down, buoyant force up, center of buoyancy, center of gravity,	HO #4A Underwater Vol
Lesson #5	Combined center of gravity, Volumes, Archimedes Principle HW Find <i>combined</i> center of gravity for fuel tanks	HO #5A Combined c.g HO #5B Structural parts

Lesson #6	Forces are transmitted through the ship's structure. Area-Moments-of-Inertia, parallel axis theorem	HO #6A Area Moment
Lesson #7	Graded Assignment #1 is going out. Find the Volume and Center of Gravity	HO –Graded assignment #1
Lesson #8	Area moment of inertia for a composite piece. Hull pressure forces, more parallel axis theorem	HO #8A Area Moment HO #8B Pressure forces

Lesson #9	Metacenter, metacentric height, righting arm, righting moment	HO #9A Reserve Buoy Metacenter 2 pg HO #9B Righting arm HO #9C Stability
Lesson #10	Positive and negative stability Pg 31 Text, Angle of Loll, Transverse shifting of weight already onboard	HO #10A Positive stability HO #10B Shifting a weight
Lesson #11	Stability triangle, list triangle, Why does a ship float? Intro to the Trim & Stability Booklet	HO #11A Stability triangle HO #11B List triangle HO #11C Tank capacity HO #11D Kennedy Hydro

Lesson #12	Classroom – example problems	NO Handouts
Lesson #13	Intro to Ship's Trim & Stability Booklet Adding a weight, calculating angle of list, start Free Surface HW Taking moments about an axis	HO #13A Adding a wt HO #13B Free surface
Lesson #14	Free Surface formula, introducing the virtual center of gravity HW Weight addition	HO #14A Virtual c.g. 2 pgs

MONDAY 9 OCT is a HOLIDAY – Columbus Day

Lesson #15	A DEAN'S MONDAY Developing the Free Surface Correction formula Calculating a tank's Free Surface Correction (FSC),	HO #15B Develop FSC formula HO #15C Class example problem
Lesson #16	Calculating a SHIP'S total Free Surface Correction for ALL tanks. Noon Report, Trim & Stability summary sheet	HO #16A Noon report 2 pgs
Lesson #17	Free Surface example problems	HOs #17A, HO #17B FSC prob (2 pgs).

	Start: STABILITY at LARGE ANGLES of Heel	Chap 7
Lesson #19	Transverse Stability at large angles of heel, Static Stability Curve, Assumed KG, Intact Stability Criteria using Righting Arm curves HW Static Stability going out – draw corrected curve	HO #19A Static stab. 2 pgs HO #19B Intact Stab criteria
Lesson #20	Application of trim and stability information. Graded Assignment #2 - Trim & Stability calculations Due: Wed 1 NOV, in class	HO #20A Trim & Stability instructions 4 pgs
	Start: LONGITUDINAL HULL STRENGTH	Chap 10
Lesson #21	Some ship structural pieces, hogging, sagging, Model the ship as a Box-Beam,	HO #21A Structural pieces HO#21B Hog, sag, Box Beam

Lesson #22	Flexure Formula, Video – Why ships sink	HO #22A Flex formula(text) HO #22B Flex formula 2 pgs
Lesson #23	Framing Systems , develop ship strength curves; Ship's Weight curve, Buoyancy curve, and Load curve Graded assignment #2 is due today.	HO #23A Framing HO #23B Weight curve 2 pgs
Lesson #24	Ship Strength curves Develop barge's Weight per foot $W(x)$, $B(x)$, $L(x)$ Shear Force $V(x)$, Bending Moment Curve $M(x)$	HO #24A Wt/ft, $B(x)$ 2 pgs HO #24B Shear curve, Bending moment curve

Mon 6 Nov Lesson #25	More Ship Strength curves, Strength calculations, Class example problem	HO#25A Five strength curves
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		HO #25B Class ex. problem
Wed 8 Nov Lesson #26	Intro to Section Modulus, Ship construction, Subdivision and “Tonnage”	HO #26A Section Modulus HO #26B How Modulus is used HO #26C Tonnage
FRIDAY 10 NOV	FRIDAY, 10 NOV is a HOLIDAY – VETERAN’S DAY	

Mon 13 Nov Lesson #27	Understanding fundamental actions to be taken in the event of loss of intact stability. Ballast water management	HO #27A Ballasting
Wed 15 Nov	Review for exam #2	
Fri 17 Nov	EXAM #2 FRIDAY 17 Nov	

Mon 20 Nov Lesson #28	Materials used in construction. Graded HW #3 goes out GRADED HW #3 is due Fri 1 Dec Return exams	
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TUES, 21 NOV - COMMENCE THANKSGIVING BREAK AFTER LAST CLASS.
So, we have no NAV ARCH classes Wed 22 Nov, or Fri 24 Nov.

Mon 27 Nov Lesson #29	RESISTANCE to the SHIP moving through the water Intro to Ship Resistance, 3 types of resistance	HO #29 Total hull resistance
Wed 29 Nov Lesson #30	Towing a model, Effective Horsepower (EHP) Use of models, Law of Corresponding speeds Ship Resistance and Modeling, scale factors	HO #30 Scaling example 2 pgs
Fri 1 Dec Lesson #31	Explosive limits, Inert Gas systems Graded Assignment #3 is due.	HO #31A Explosive range HO #31B Inert gas system

Mon 4 Dec	Ship-model power and speed relations	HO #33A
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Lesson #33	Hull speed, Power along basic drive train	Hull speed HO #33B Ship drive 2 pgs HO #33C
Wed 6 Dec Lesson #34	Ship's Trim and draft marks. Ship propeller basics.	HO #34A Propeller pitch
Fri 8 Dec Lesson #35	Drydocking information	NO HANDOUTS

Mon 11 Dec	Review for exam	
Wed 13 Dec	Last DAY OF CLASS. Exam #3 will be given in class on this day	A 50 – minute exam (in class)