

Course: EN-4151 APPLIED NAVAL ARCHITECTURE

Credits: 3

Professor: F. Murray

Semester: Spring 2016

Office: Room 222A Harrington

Text: Stability and Trim for the Ship's Officer

Prerequisite: EN 3112 – Strength of Materials

Office Hours:

Rm 222A Harrington, 1000 - 1100, or by appointment

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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 (5%) Exam #1 (25%), Exam #2 (25%), Final exam (30%),

Graded Homeworks (15%)

Attendance: If you are going to miss a class, please advise me prior to that class. The student is responsible for catching up with the material that was missed. A student missing 12 or more classes may be dropped from the course.

Notes

1. Quizzes: There will be no makeup of quizzes. Unexcused absences will receive a grade of zero for that quiz.
2. Cadets with disabilities: Students with documented disabilities will be afforded appropriate accommodations. Students requiring additional time on exams must make those arrangements with the instructor in advance.

Learning Outcomes:

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

1. Will be conversant with the basic nomenclature of ship structure and ship stability.
2. Will be able to use a ship's hydrostatic curves-of-form to calculate displacement and other initial stability information.
3. Will have a working knowledge of stability basics and the effect of load changes on stability. This includes use of hydrostatic curves of form and cross curves of stability.
4. Will have a working knowledge of how loading changes a ship's longitudinal trim and transverse list.
5. Will have a working knowledge of the causes and effects of stress on a ship's hull.
6. Will understand what structural hull loads are, and be able to calculate basic longitudinal hull stress for a simplified loading.
7. Will understand the importance of maintaining watertight integrity.
8. Will be able to estimate a ship's power requirement based on model test data.

STCW Learning Objectives

Demonstrate knowledge and understanding of the following STCW elements:

- OICEW-C1.1 Characteristics and limitations of materials used in construction and repair of ships and equipment
- OICEW-C1.4 Methods for carrying out safe emergency/temporary repairs
- OICEW-D2.1 Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment
- OICEW-D2.2 Understanding of the fundamentals of watertight integrity
- OICEW-D2.3 Understanding of 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

APPLIED NAVAL ARCHITECTURE – SPRING 2016

	TOPIC		TEXT
1	Administrative issues. Nomenclature, Finding Areas	P	
2	More nomenclature, molded form, dimensions Finding Center of Area, Finding Center of Gravity Graded HW is assigned - Find Center of Gravity	P	
3	Relationships: Underwater volume, weight, specific weight Fluid weight, start Archimedes Principle	P	
4	Properties of the waterplane, properties of the immersed hull Archimedes Principle	P,V	
5	Force of Buoyancy, center of buoyancy, ship's center of gravity, Also see "Block coefficient ratio" (see diagram on pg 72, text)		See pg 72
6	Forces are transmitted through the ship's structure. Review of Area-Moment-of-Inertia, parallel axis theorem	V, P	
7	Intro to Hydrostatic Curves Tons per inch immersion Class handout, plus see text pg 443 for another set-of-curves	P, V	Appendix A pg 443
8	Hull pressure forces, more parallel axis theorem	P	
9	Righting moment (force x distance), righting arm (distance) Initial Transverse Stability at small angles, Intro. to Transverse Metacenter, M_T and Metacentric Height		Chap 2 pg 31-37 pg 40-46
10	Positive, neutral stability Pg 31 Text, Angle of Loll, pg 118	P	pg 31- 46, start Chap 3
11	Load lines, vessel's Plimsoll mark. List, heel and loll Why does a ship float?	P	
12	Intro to the Trim & Stability Booklet, KG, Lightship definition The effect of off-center weights Transverse Shifting of a Weight already onboard		pg 54 - 59
13	Using T.S. Kennedy Hydrostatic tables Adding a weight, removing a weight	P,V	
14	Start Free Surface , Effect of Free Surface, Virtual rise in G	V	Chap 6
15	Free Surface definitions, Noon report		
16	Free surface correction (FSC) , example problem Basic structural nomenclature		
17	Characteristics and limitations of materials used in shipbuilding Review for exam		
Mon	EXAM #1 MONDAY 11 APRIL		
18	Return exams, Video- Sunken Ship Salvage - Start Patriot's Holiday		

**Patriot's Holiday Thursday April 14th - Monday, April 18th.
Resume Nav Arch class on Wednesday, 20 April.**

STABILITY at LARGE ANGLES		Chap 7
19 W	Transverse Stability at large angles of heel, Static Stability Curve, Assumed KG, Intact Stability Criteria using Righting Arm curves	P pg 129-136
20 F	Working knowledge and application of trim and stability Graded HW is assigned: Trim & Stability calculations	P

LONGITUDINAL HULL STRENGTH		Chap 10
21 M	Ship Structure – static load, dynamic load. Model the ship as a Box-Beam, Still Water	pg 218 - 228
22 W	Flexure Formula, Video - Why ships Sink	V pg 228
23 F	Framing Systems, transverse or longitudinal or combination Ship Strength - Weight curve, Buoyancy curve, Load curve	P pg 229 - 238
24 M	Ship Strength curves - Barge example Weight per foot $W(x)$, $B(x)$, $L(x)$ Shear Force $V(x)$, Bending Moment Curve $M(x)$	pg 232 - 238
25 W	Ship Strength curves - Strength calculations	
26 F	Hull monitoring systems	

27 M	Section Modulus, Subdivision	P	Handout
28 W	STCW codebook, Review for exam #2		
FRI	EXAM #2 FRIDAY 13 MAY		
	CG LICENSE EXAM WEEK 16 - 20 MAY NO CLASSES for ENTIRE WEEK		
29 M	Fundamentals of watertight integrity Understanding fundamental actions to be taken in the event of loss of intact stability		
30 W	RESISTANCE to the SHIP moving through the water Intro to Ship Resistance, 3 types of resistance Resistance to the ship as it moves through the water	P	
31 F	Towing a model, Effective Horsepower (EHP) Use of models, Law of Corresponding speeds Ship Resistance and Modeling, scale factors	P	

32 TUE	Ship Propulsion, Horsepowers and basic drive trains Hull speed **THIS DAY IS A "DEAN'S MONDAY"	P, V	
33 W	Ship- model relationships,		
34 F	Ship propeller basics	P	
35 M	Last day of class, review for final exam		