

**Course: EN-4151 APPLIED NAVAL ARCHITECTURE**

**Credits:** 3

**Professor:** F. Murray

**Semester:** FALL 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, 1100 - 1200, 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 – FALL 2016

	TOPIC		TEXT
1 W	Administrative issues. Nomenclature, Finding Areas	P	
2 F	More nomenclature, molded form, dimensions Finding Center of Area, Finding Center of Gravity <b>Graded Homework "A" is assigned - Find Center of Gravity</b>	P	
3 M	Relationships: Underwater volume, weight, specific weight	P	
4	Properties of the waterplane, properties of the immersed hull Center of buoyancy, ship's center of gravity	P, V	
5	Force of Buoyancy, center of buoyancy, ship's center of gravity, Archimedes Principle		See pg 72
6 M	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 M	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, negative stability Pg 31 Text, Angle of Loll, pg 118 Transverse shifting of weight already onboard	P	pg 31- 46, start Chap 3
11	Load lines, vessel's Plimsoll mark. List, roll and loll Why does a ship float?	P	
12 M	Intro to the Trim & Stability Booklet, KG, Lightship definition The effect of off-center weights, Kennedy Hydrostatic tables		pg 54 - 59
13	Adding a weight, calculating angle of list, start Free Surface	P, V	
14	More Free Surface, slack tank, Ship's six degrees of motion	P	Chap 8
	<b>MONDAY 10 OCT is a HOLIDAY - No class</b>		Free Surface
15W	Calculating a tank's free surface correction (FSC) Class example problem		
16 F	Calculating a SHIP'S total Free Surface Corr. due to ALL tanks Noon Report, Trim and Stability summary sheet		
17 M	Characteristics and limitations of materials used in shipbuilding Review for exam #1		
Wed	<b>EXAM #1 WEDNESDAY 19 OCTOBER</b>		
18F	Return exams, Video Sunken Ship Salvage		

	<b>STABILITY at LARGE ANGLES</b>		Chap 7
19 M	Transverse Stability at large angles of heel, Static Stability Curve, Assumed KG Intact Stability Criteria using Righting Arm Curves	P	pg 129-136
20 W	Working Knowledge and application of trim and stability <b>Graded HW "B" is assigned: Trim &amp; Stability calculations</b>		
21F	<b>LONGITUINDAL HULL STRENGTH</b> Ship structure - static load, dynamic load Model the ship as a box-beam,		Chap 10 pg 218 - 228

22 M	Flexure Formula, Video - Why ships Sink	V	pg 228
23 W	Framing Systems, transverse or longitudinal or combination Ship Strength - Weight curve, Buoyancy curve, Load curve	P	pg 229 - 238
24 F	Ship Strength curves: Barge example Weight per foot $W(x)$ , $B(x)$ , $L(x)$ Shear force $V(x)$ , Bending Moment Curve $M(x)$	P	pg 232 - 238
25 M	Ship Strength curves - Strength calculations <b>Graded HW "C" is assigned: Strength curves</b>		
26 W	Hull Stress Monitoring, intro to Section Modulus	P	
27 TH	<b>THURSDAY, 10 NOV is a DEAN'S FRIDAY</b> Tonnage, Subdivision, STCW code		
	<b>FRIDAY, 11 NOV is a holiday, Veteran's Day</b>		
28 M	RESISTANCE to the SHIP moving through the water Intro to Ship Resistance, 3 types of resistance	P	
29 W	Towing a model, Effective Horsepower (EHP) Use of models, Law of Corresponding speeds Ship Resistance and Modeling, scale factors	P	
30 F	Ship - Model relations, Ship propulsion horsepowers and basic drive train, review for exam #2	P, V	
Mon	<b>EXAM #2 MONDAY, 21 NOV</b>		
	<b>THANKSGIVING BREAK</b>		

31 M <i>28Nov</i>	Nav Arch (guest speaker) Flooding at sea, car carrier, Watertight bulkheads		
32W	STCW codebook, understanding fundamental actions to be taken in the event of loss of intact stability		
33 F	CG Exam questions - Calculations		
34 M	Nav Arch (guest speaker)		
35W	Leadership & Mngt		
36 F	Ship propeller basics		
37 M	Miscellaneous		
38W	14 Dec, Last day of classes , review for Final Exam		