

Massachusetts Maritime Academy
Internal Combustion Engines II (EN-4131-17)
Fall 2022

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Office Hours: Wed 1200-1400 and Fri 1300-1400 and by app

Recommended Texts

1. Marine Engineering Workbook Volumes Two and Three
Preparation for the USCG License Examination 7th edition
2. Motor Plants Illustrations Workbook 2019 edition by Alan Gillis

COURSE INFORMATION

DESCRIPTION: This is the second of a two course Internal Combustion Engine sequence. In ICE I Students learned the basic principles of construction, operation, maintenance and repair of both 2 stroke and 4 stroke diesel engines of slow, medium and high speed. This course builds on the knowledge obtained in ICE I by investigating complete systems and their applications. Particular emphasis will be placed on Lubrication, Fuel, Cooling, Starting, Governing, Waste Heat, Gearing, and Purification Systems.

This is a required course for all Marine Engineering students and contains STCW knowledge and practical elements. A grade of “ C- “or better is required.

ICE II Lab (EN-4131L) is a separate signup but part of this course and is fundamental to fully understand the concepts covered in ICE II and must be taken concurrently with this course.

PREREQUISITE: ICE I (EN-2232) and ICE I Lab (EN-2232L)

Course Format: You are expected to be physically in class for every lecture. Attendance will be taken as per STCW requirements. **Unexcused absences will result in a 1% grade deduction for each occurrence.**

Classroom Protocols:

There will be NO eating or drinking in the classroom at any time. The only exception is you may have your own water in a sealable container with you.

Unless specifically allowed by Administrative authority, the proper classroom uniform of the day must be worn in class. **Coveralls may be worn in class under unusual circumstances only and must be prearranged!**

Assignments: Tests and assignments will be conducted either in person or through blackboard at the teacher's discretion. However, you will submit all external assignments through blackboard unless told otherwise. Multiple choice assignments may require you to answer directly on line whereas other assignments may require you to download, print out and upload your answers. I have used this method for the previous 5 semesters with much success. You will be given a well defined timetable for work submissions. A continuously updated schedule and assignment spreadsheet will be placed on blackboard.

LATE assignments will not be accepted without prior arrangement. Blackboard will be configured to time you out if not completed by the deadline.

Assignments must be submitted by one of these two methods, A Microsoft product such as word or excel, or a PDF document. Failure to do so will result in a zero for the assignment or test.

Homework: Weekly homework will be assigned and will be based solely on material covered in class. Homework should be neat. A "straight edge" or CAD program should be used for any sketches. *Unit labels must be carried out throughout the problem or no credit will be given for that problem.* Check all math and dimensions. All homework will be due on the date stated in blackboard. **Late homework will not be accepted. It is impossible to get a good grade without doing your homework** and it is hard to get a bad grade if you do your homework!

GRADING:	Tests (3)	45%
	Homework & quizzes	55%

Final Exam: The final exam will consist entirely of USCG questions given to the 2022 graduating class. The ENTIRE motor question database is fair game! Topics from Diesels I and Diesels II will be included. The final counts as one of the 3 tests. **Everyone will take the final.**

Disclaimer: This syllabus is intended to serve as a guide to the range of topics that will be addressed in EN4131 but the topics and sequence are subject to adjustment or change based on the needs of the class. It also goes without saying the format may change based on both the needs of the class and regulatory oversight.

Study tips: Exams, quizzes and homework will focus exclusively on material covered in class. Attendance is mandatory for this reason! If you follow along in class and complete all homework, there will be no surprises.

Electronics: Cell phones must be silenced and remain out of sight. Violations may be subject to grade deductions of up to 1% of the final grade per violation.

The ADA Coordinator, Asst. Dean Elaine Craghead, evaluates the documentation provided, determines appropriate services, and is available to discuss accommodations with students. The Disability Resources office is located in the Academic Resource Center, ABSIC 320. Students can drop in during normal business hours, M-F 0800-1600, or call x5120, or email ADAcompliance@maritime.edu.

Learning Outcomes - At the successful completion of the course, the student will fulfill the following STCW requirements:

Demonstrate knowledge and understanding of the following STCW elements:

OICEW-A4.2: Safety and emergency procedures for operation of propulsion plant control systems
OICEW-A4.3 Preparation, operation, fault detection and measures to prevent damage for main engine and associated auxiliaries
OICEW-B1.2 Main propulsion plant operational control systems

Demonstrate proficiency in the following skills:

OICEW-5-1J Prepare main propulsion diesel engine for operation
OICEW-5-1K Secure main propulsion diesel engine
OICEW-7-1A Start emergency generator
OICEW-7-1B Pre-start inspection of diesel generator

Other Objectives

- Correctly start and operate a diesel engine
- Correctly maintain and repair diesel engines.
- Troubleshoot operational problems
- Be able to pass the USCG license exam for third assistant engineer, motor section.

Week	<u>TOPICS</u>	<u>READING</u>
1-2	Lube Oil and Lube Oil Systems	Handouts
3-4	FO & LO Purification systems	Handouts
5	FO Systems Review	Handouts
6	Engine Coolants and Cooling Systems	Handouts
7	Air Intake Systems	Handouts
8	Supercharging and Exhaust Systems	Handouts
9-10	Waste Heat Recovery and Auxiliary Boilers	Handouts
11	Starting, Reversing and Drive Trains	Handouts
12-13	Governors and Engine Speed Control	Handouts
14	Engine Emissions and Control	Handouts
15	Operation & Troubleshooting	Handouts

ICE II Topics will also cover questions from the Marine Engineering workbook as per the table shown below. The topics are boxed into the week each topic will be discussed.

6. Motor Plants

609

Diesel Theory	.610	Lube Oil	.699
Two-Stroke Cycle	.615	Lube Oil Systems	.705
Four-Stroke Cycle	.616	Lube Oil Filters, Strainers	.708
Firing Order, Timing	.617	Centrifuges	.711
Indicator Diagrams, Indicators	.619	Cooling Systems	.720
Calculations	.623	Coolants	.726
Frames and Crankcase	.625	Expansion Tanks	.727
Crankcase Explosion	.627	Heat Exchangers	.727
Cylinder Liners	.629	Thermostats	.728
Cylinder Lubrication	.632	Air Intake Systems	.729
Cylinder Heads	.634	Scavenging	.730
Combustion Chambers	.635	Roots Blowers	.732
Pistons	.637	Turbocharging	.733
Piston Rings	.640	Aftercoolers	.737
Piston Cooling	.645	Exhaust Systems	.739
Connecting Rods	.646	Pyrometers	.742
Crankshafts, Flywheels, Vibration	.649	Mufflers	.742
Vibrations	.650	Exhaust Emissions	.743
Journal Bearings	.652	Waste Heat Boilers	.744
Thrust Bearings	.654	Auxiliary Boilers	.747
Cams	.657	Auxiliary Boiler Operation	.751
Camshafts	.657	Auxiliary Boiler Control	.755
Valves, Valve Gear	.659	Distillers	.760
Hydraulic Lash Adjustors	.664	Drive Trains, Timing Gears	.764
Valve Adjustment	.665	Reduction Gears	.764
Diesel Engine Governors	.666	Couplings, Clutches	.768
Overspeed Trips	.673	Starting and Reversing	.770
Control Systems	.675	Air Start Systems	.773
Fuel Oil	.677	Hydraulic Start Systems	.778
Fuel Oil Systems	.681	Electric Start Systems	.779
Oil Analysis	.685	Bendix Drives	.779
Fuel Injection Systems	.686	Starting Aids	.780
Injectors	.688	Diesel Trouble Shooting	.781
Fuel Injection Pumps	.692	Diesel Plant Operation	.786
Injection Timing and Metering	.695		

Handwritten annotations in the table include curly braces and arrows grouping items into weeks:

- Items 699-708 are grouped with a brace labeled "1-2".
- Items 708-720 are grouped with a brace labeled "3-4".
- Items 720-737 are grouped with a brace labeled "6".
- Items 737-742 are grouped with a brace labeled "7".
- Items 742-747 are grouped with a brace labeled "8".
- Items 747-755 are grouped with a brace labeled "9-10".
- Items 755-773 are grouped with a brace labeled "11".
- Items 773-781 are grouped with a brace labeled "12-13".
- Items 781-786 are grouped with a brace labeled "14-15".
- Items 612-613 are grouped with a brace labeled "5".