

Massachusetts Maritime Academy
Internal Combustion Engines I (EN-2232)
Spring 2022

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Office Hours: M&W 11-1150, & W 1300-1350 and by appointment. I will also be available by prearranged appointment many other times during the class day.

Required TEXTS: **Handouts only**

Recommended Text: **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 a foundation course for future marine engineering courses. Students will learn 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 is the first course of a two course Internal Combustion Engine sequence. ICE II is typically taken during the first semester senior year.

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

COREQUISITE: Calculus I (SM-1212)

Course Goals:

To prepare the Student to properly **start, operate and maintain** Marine Diesel Engines

To prepare the Student to troubleshoot and repair Marine Diesel Engines

To prepare the Student to pass the USCG administered 3rd Assistant Marine Engineer’s License

Learning Outcomes - At the completion of the course, the student should be able to:

- Correctly start and operate a diesel engine
- Correctly maintain and repair diesel engines.
- Troubleshoot operational problems
- Calculate the indicated horse power
- Identify the engine components and use the correct terminology

This course helps fulfill the following STCW components:

Must be able to demonstrate knowledge and understanding of the following STCW elements:

- [AB-E-A5.1](#) Basic knowledge of the function of main propulsion machinery
- [AB-E-A5.1](#) Basic knowledge of the operation of main propulsion machinery
- [OICEW-A4.1](#) Basic construction and operation principles of marine diesel engines
- [OICEW-A4.2](#) Safety and emergency procedures for operation of propulsion plant machinery

GRADING:	Quizzes (3-4) & Homework	55%
	Tests (3)	45%
	Labs	See Below

All Grades will be entered in blackboard for your reference. However, **BE WARNED!** Blackboard DOES NOT compute your course average correctly. You must see me if you want your course average during the semester. You can also compute it yourself.

Attendance: It is expected students will come to class on time and not leave early. Late arrivals and early departures are distracting to the class. You must be present for all tests and labs. There will be **NO** quiz make-ups. Unexcused absences will be assigned a grade of zero for the missed work.

Let me know **in advance** by email or in person if you must miss a class or lab. Labs are mandatory. **Everyone will take the final. For each *unexcused* absence there will be a 2% deduction from the final course average. The student must let the instructor know about expected absences by email.**

LABS: Lab participation is critical. **A missed Lab will result in a grade of Incomplete for the course.**

Homework: Weekly homework will be assigned and will be based solely on material covered in class. Homework should be neat and the pages stapled together. A ruler or “straight edge” 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. Box and label answers. Every page should contain your name, the course number and the assigned due date. All homework will be due in class on the following class unless stated otherwise. Some homework will be completed entirely on Blackboard. Late homework will not be accepted.

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.

Quizzes: May or may not be pre-announced. Go to class!

Electronics: Cell phones must be silenced and remain out of sight. Violations may be subject to grade deductions of up to 2% of the final grade per violation.

Calculators: **Only non programmable calculators will be allowed for exams.**

“Smart Watches” Must remain out of sight during tests and quizzes. Violations will be an honor offense and result in a zero for the day at a minimum.

Week	<u>TOPICS/ASSIGNMENTS</u>	<u>READING</u>
1	Introduction to the Diesel Engine Operating Principles, 2 and 4 Stroke	Handouts
2	Efficiencies, Losses, Basic Calculations Assembly of a Diesel Engine & Parts	Handouts
3-4	Valves, Valve Gear and Cylinder heads	Handouts
5-6 TEST #1	Pistons, Conrods and Crankshafts	Handouts
7	Frames, Liners and Crankcase Explosion	Handouts
8-10	Fuel Oil, Injection & Fuel Systems	Handouts
11 TEST #2	Air Intake Systems, Scavenging, Turbocharging	Handouts
12	Exhaust Systems, Mufflers, Emissions	Handouts
13	Vibration and Bearings	Handouts
14 TEST #3 Cumulative Final	Basic Troubleshooting	Handouts

Blackboard: All Handouts, Classroom Videos and Homework will be posted on blackboard for your reference. Blackboard will not be used for any other purpose.

MMA is committed to providing reasonable accommodations to students with documented disabilities. Students who believe they may need accommodations in this class are required to contact Fran Tishkevich, Director of Disability Compliance, within the first two weeks of class at ext. 2208 or by email ftishkevich@maritime.edu

Disclaimer: This syllabus is intended to serve as a guide to the range of topics that will be addressed in EN2232 but the topics and sequence are subject to adjustment or change based on the needs of the class.

ICE I 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.

WEEK	6. Motor Plants	609 WEEK
1	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
2	Indicator Diagrams, Indicators 619	Cooling Systems 720
	Calculations 623	Coolants 726
7	Frames and Crankcase 625	Expansion Tanks 727
	Crankcase Explosion 627	Heat Exchangers 727
	Cylinder Liners 629	Thermostats 728
3-4	Cylinder Lubrication 632	Air Intake Systems 729
	Cylinder Heads 634	Scavenging 730
5-6	Combustion Chambers 635	Roots Blowers 732
	Pistons 637	Turbocharging 733
13	Piston Rings 640	Aftercoolers 737
	Piston Cooling 645	Exhaust Systems 739
	Connecting Rods 646	Pyrometers 742
3-4	Crankshafts, Flywheels, Vibration 649	Mufflers 742
	Vibrations 650	Exhaust Emissions 743
8-10	Journal Bearings 652	Waste Heat Boilers 744
	Thrust Bearings 654	Auxiliary Boilers 747
11	Cams 657	Auxiliary Boiler Operation 751
	Camshafts 657	Auxiliary Boiler Control 755
12	Valves, Valve Gear 659	Distillers 760
	Hydraulic Lash Adjustors 664	Drive Trains, Timing Gears 764
14	Valve Adjustment 665	Reduction Gears 764
	Diesel Engine Governors 666	Couplings, Clutches 768
14	Overspeed Trips 673	Starting and Reversing 770
	Control Systems 675	Air Start Systems 773
14	Fuel Oil 677	Hydraulic Start Systems 778
	Fuel Oil Systems 681	Electric Start Systems 779
14	Oil Analysis 685	Bendix Drives 779
	Fuel Injection Systems 686	Starting Aids 780
14	Injectors 688	Diesel Trouble Shooting 781
	Fuel Injection Pumps 692	Diesel Plant Operation 786
14	Injection Timing and Metering 695	

Classroom Protocols:

As per ongoing administrative emphasis: All students must be in the proper classroom uniform. There is no eating or drinking allowed in the classroom!