

**Massachusetts Maritime Academy**  
**Internal Combustion Engines I (EN-2232)**  
**Spring 2016**

Assistant Professor: David Splaine  
Office: Harrington 221A  
Phone: X-2059  
email: [dsplaine@maritime.edu](mailto:dsplaine@maritime.edu)

**Office Hours:** Mon, Wed and Fri 0900-1000 and by appointment. I will also be available at least one evening every week.

**TEXTS:**                   **Handouts only**

Recommended Text:   Marine Engineering Workbook Volumes Two and Three  
Preparation for the USCG License Examination

**Reference Website:** <http://www.marinediesels.info/index.html>

**This is a fantastic website dedicated to marine diesels of all types. We will make use of this site in class. If you're serious about learning about marine diesels then you need to spend time on this site!**

#### **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 3<sup>rd</sup> 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

<b>GRADING:</b>	Quizzes (3-4)	20%
	Tests (3)	45%
	Homework	35%
	Labs	See Below

**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 F 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. 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. Laptop note taking will not be necessary nor allowed. Therefore, Laptops or any Ipad type devices will not be allowed in class. 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.**

## TOPICS/ASSIGNMENTS

## READING

- |   |          |
|---|----------|
| 1. Introduction to the Diesel Engine    | Handouts |
| 2. Operating Principles, 2 and 4 Stroke | Handouts |
| 3. Efficiencies and Losses              | Handouts |
| 4. Diesel Power Plants                  | Handouts |
| 5. Construction and Terminology         | Handouts |
| 6. Bedplates and Construction           | Handouts |
| 7. Combustion and Emissions             | Handouts |
| 8. Maintenance and Repair               | Handouts |
| 9. Air Supply Systems                   | Handouts |
| 10. Fuels and Fuel Injection System     | 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](mailto: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:

Boiler Operation.....	440		
<b>INTERNAL COMBUSTION ENGINES I EN 2232</b>			<b>67,68</b>
Chapter 5	<b>Motor Plants</b>	<b>FINAL EXAM TOPICS</b>	<b>(inclusive) 1-25, 29-34, 45-47, 499</b>
1 Diesel Theory.....	500	85 Lube Oil.....	584
2 Two-Stroke Cycle.....	504	36 Lube Oil Systems.....	588
3 Four-Stroke Cycle.....	506	37 Lube Oil Filters.....	591
4 Firing Order, Timing.....	506	38 Centrifuges.....	593
5 Indicator Diagrams, Indicators.....	508	39 Cooling Systems.....	602
6 Calculations.....	512	40 Coolants.....	607
7 Frames and Crankcase.....	514	41 Expansion Tanks.....	607
8 Crankcase Explosion.....	516	42 Heat Exchangers.....	608
9 Cylinder Liners.....	518	43 Thermostats.....	609
10 Cylinder Lubrication.....	521	44 Air Intake Systems.....	610
11 Cylinder Heads.....	521	45 Scavenging.....	611
12 Combustion Chambers.....	523	46 Roots Blowers.....	613
13 Pistons.....	525	47 Turbocharging.....	614
14 Piston Rings.....	528	48 Aftercoolers.....	618
15 Piston Cooling.....	533	49 Exhaust Systems.....	619
16 Connecting Rods.....	534	50 Pyrometers.....	622
17 Crankshafts, Flywheels, Vibration.....	536	51 Mufflers.....	623
18 Vibrations.....	537	52 Exhaust Smoke.....	623
19 Journal Bearings.....	538	53 Waste Heat Boilers.....	625
20 Thrust Bearings.....	541	54 Auxiliary Boilers.....	627
21 Cams.....	543	55 Auxiliary Boiler Operation.....	631
22 Camshafts.....	543	56 Auxiliary Boiler Control.....	635
23 Valves, Valve Gear.....	545	57 Distillers.....	640
24 Hydraulic Lash Adjustors.....	550	58 Drive Trains, Timing Gears.....	644
25 Valve Adjustment.....	551	59 Reduction Gears.....	644
26 Diesel Engine Governors.....	553	60 Couplings.....	646
27 Overspeed Trips.....	559	61 Starting and Reversing.....	649
28 Control Systems.....	560	62 Air Start Systems.....	652
29 Fuel Oil.....	563	63 Hydraulic Start Systems.....	656
30 Fuel Oil Systems.....	566	64 Electric Start Systems.....	657
31 Fuel Injection Systems.....	570	65 Bendix Drives.....	658
32 Injectors.....	572	66 Starting Aids.....	659
33 Fuel Injection Pumps.....	576	67 Diesel Trouble Shooting.....	659
34 Injection Timing and Metering.....	579	68 Diesel Plant Operation.....	664