Massachusetts Maritime Academy – Department of Marine Engineering
Auxiliary Machine I EN-1222
Spring 2025

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Office Hours: Monday, 0900-1100 and Tuesday, 1300-1400, or by appointment

Prerequisites:

Engineering Systems and Safety
Precalculus

Entrance Requirements

- Demonstrate a basic understanding of piping systems
- Understand the construction and function of valves
- Understand the operation and design of pressure and temperature-regulating devices
- Understand the construction, operation, and function of pressure and temperature-measuring devices

Texts:

Excerpts from DOE Fundamentals Handbook
(Optional) Engineering Training Manual TS Kennedy (Haynes)
USCG Workbooks
(Optional) Modern Marine Engineer's Manual, Vol. 1 (Osbourne or Hunt)

COVID-19:

If we must move to an online learning format, all material will be presented via Blackboard. The course will switch to a blend of synchronous and asynchronous methods. An updated syllabus will be provided.

Caution:

- Cell phones will be taken and given to the Dean. Students are expected to bring notebooks and writing utensils.
- Programmable calculators are NOT allowed during quizzes and exams.
- Cell phones may NOT be used as calculators.
- NO smart watches may be used in class, during quizzes, or the final.
- Once class starts, if a cadet leaves the room, this cadet will not be allowed back into the class.
- No food or drink is allowed in the classroom except bottled water.
- All COVID-19 protocols and policies will be followed.
- If required as the semester progresses, you must always wear a mask that covers your nose and mouth in the lecture hall or classroom.

Course Description:

EN -1222 lays the foundation for future engineering courses. Students will learn the basic principles of construction, operation, maintenance, and repair of piping systems. Topics include pipe and fittings, valves, pumps, heat exchangers, pressure, temperature, level and flow measurement, piping and instrumentation diagrams (P&ID), and blueprint reading. Both shoreside and marine applications are discussed. [Lab time required]

Attendance:

- Attendance is mandatory for all class lectures and lab instruction. Special liberties DO NOT COUNT as an excused absence.
- Students with perfect attendance will have their lowest quiz grade dropped. NO make-up quizzes will be offered even with an excused absence, and **NO QUIZZES WILL BE DROPPED**. Missing a quiz equals **ZERO.**
- The final grade will be reduced by 2 percent for each unexcused lecture absence.

- Lab instruction classes are Mandatory. Disciplinary action will be taken if needed. An "Incomplete" grade will be issued if all labs are not completed by the end of the Fall 2025 semester.
- **Students who miss three (3) or more classes will automatically fail the course.**

Grading:

Quizzes	50%
Tests	30%
Lab	10%
Homework/Participation	10%

Note:

This is an STCW-required course; the only grades earned in this class will be "A, B, C, or F." The lowest passing grade is a C-. If you have below a 70, you will fail the course and have to repeat the course.

Dress Code:

All regimental cadets are required to be in the uniform of the day. No boiler suits are allowed in the classroom. For non-regimental students, business casual attire is required. For the lab, boiler suits are permitted; however, they must be clean and with no holes. If you are not in the proper uniform, you will be asked to leave, which will count as an absence.

Food & Drink:

No food and drink except water are allowed in the classroom.

Electronic Devices:

No electronic devices will be allowed in this class. The only device that can be used is a Texas Instruments TI-30XIIS calculator during indicated quizzes or tests. If an electronic device is found being used, the student will be dismissed from class, and a zero will be given for the day. The device will be given to the Dean's Office. Using a cell phone as a calculator during any test or quiz is prohibited.

Honesty:

Students are expected to be honest and forthright in their academic endeavors. Academic dishonesty includes cheating, inventing false information or citations, plagiarism, computer tampering, destroying other people's studio property, or academic misconduct. Plagiarism and cheating are not permitted. Students caught cheating will receive a zero for the assignment and may receive a failing grade for the entire course.

Use of AI Tools:

This course requires you to complete various assignments that assess your understanding and application of the course content. You are expected to do your own work and cite any sources you use correctly. You cannot use any artificial intelligence (AI) tools, such as chatbots, text generators, paraphrasers, summarizers, or solvers, to complete any part of your assignments. Using AI tools is considered academic dishonesty and will result in a zero grade for the assignment and possible disciplinary action. If you have any questions about the acceptable use of AI tools, please consult the instructor before submitting your work.

Class Policy:

Respect for your classmates and the instructor is paramount. You may be dismissed from class for any behaviors considered as distractions, including, but not limited to:

• Arriving late to class or leaving the classroom without permission from the instructor
• Performing a repetitive act that is annoying or loud or having prolonged side conversations
• Providing inappropriate comments to the instructor or classmates
• Not turning off or muting your cellphone may cause phone rings, beeps, vibrations, etc.
• Sleeping, reading a newspaper, browsing social media, or using your phone for anything (including text messaging) at any time during class

The instructor initially, either generally or individually, as part of the instructor's classroom management

efforts will address any distracting behavior. Cases in which such annoying behavior becomes excessive and the student refuses to respond to the faculty member's efforts will be referred to the registrar, academic advisor, Department Chair, and maybe to the Academic Dean, and you may be dismissed from class – even if it is during an exam.

Blackboard:

Blackboard will enhance the overall course content. It will be used to upload lectures, handouts, and videos. You are responsible for checking your Blackboard for material and ensuring you can log in. Homework will also be turned in and passed out on Blackboard, and online quizzes will be available.

Homework:

Homework will be assigned and used to prepare cadets for quizzes. All assignments must be turned in on the due dates, with no exceptions. Late or illegible homework will not be accepted and will be graded as a zero. Not all homework will be returned to the students.

Quizzes:

Topic material for exams/quizzes comes from the course textbook, lectures, labs, handouts, and material posted on Blackboard. Quizzes will be given each week. The instructor reserves the right to prioritize topic material, reading assignments, the number of tests, and test dates. You must take the quiz on the assigned date.

Disability Accommodation:

Massachusetts Maritime Academy is committed to providing academic accommodations to students who qualify. Students with an IEP or 504 Plan in high school or others who believe they may need and qualify for accommodations in this class are encouraged to contact Dr. S. Elaine Craghead, Assistant Dean and Academic Accessibility Services Coordinator, ideally within the first two weeks of class. Please remember that academic accommodations are not retroactive. Dr. Craghead can be contacted at ADAcompliance@maritime.edu or x5350.

GAI Policy:

This course encourages students to explore the use of generative artificial intelligence (GAI) tools such as ChatGPT for all assignments and assessments. Any such use must be appropriately acknowledged and cited. Each student is responsible for assessing the validity and applicability of any GAI output submitted; you bear the final responsibility. Violations of this policy will be considered academic misconduct. We draw your attention to the fact that different classes at Mass Maritime Academy could implement different AI policies, and it is the student's responsibility to conform to expectations for each course.

Mental Health:

If you feel overwhelmed or worried about a friend, don't hesitate to contact me or your academic advisor. We can try to help or put you in touch with someone who can. Mass Maritime Academy has trained counselors who are available to listen and help.

Academic Integrity, Academic Freedom, and Building Trust in the Classroom:

This commitment to building respect and trust in the classroom means members of this class will not record, photograph, or share any interactions involving classmates or any teaching team member online. Students will also respect the instructor's intellectual property rights. They will not share or otherwise make accessible any course materials to anyone not enrolled in the course without the instructor's written permission.

This policy is not meant to restrict students' ability to use classroom recordings in ways that are beneficial to their learning. Students who may benefit from recorded lectures and lecture playback, including those who use English as an additional language or who have accommodations from SDS, should speak to the instructor to maintain transparency and trust in the classroom. Students approved to record lectures are expected to respect and preserve the privacy of the learning environment, as stated above.

Students will also not enable anyone not enrolled in the course to participate in any activity that is associated with the course.

Exceptions to this require the instructor's written permission.

Circulating Class Materials:

All course materials are copyrighted, and it is prohibited to circulate or sell to commercial vendors the course materials, including syllabus, exams, lecture notes, images, presentations, and student papers. Such unauthorized behavior constitutes academic misconduct. Video and/or audio recording of class lectures and review sessions without my permission in advance is prohibited. If you have an accommodation letter from Student Disability Services, please make an appointment to meet during office hours before you record anything.

Reading Assignments:

Reading assignments will be posted on Blackboard at the beginning of each week. These assignments will vary depending on the pace of the class.

Readings: Will be given out and amended as the course moves along

Week 1: ESS Review:	
Safety	Intro. to Steam Engineering
LOTO	
Engineering Terms	
Steam Cycle	
Thermodynamic principles	DOE Handbook p. 9-30
Steam Tables	
Week 2: P& ID's, Measuring Instruments	
Piping and Instrumentation Diagrams	DOE Handbook p 121-176
Week 3: **Measuring Instruments, Fasteners**	
Measuring Tools	Aux. Mach. I Study Guide
Fasteners and Hardware	Aux. Mach. I Study Guide p 9-18
Torque Wrenches	Aux. Mach. I Study Guide p 37
Week 4: Pressure	
Pressure measuring instrument	DOE Handbook p 59- 71
Pressure scales, conversion factors	Aux. Mach. I Study Guide p 73-95
(Gages, Pressure Instruments, manometers, Transducers)	
Week 5: Temperature, Level Measurements	
Level Measurements	DOE Handbook pp 72-88
Temperature Scales, conversion factors	DOE Handbook pp 43-58
Temperature measuring instrument	Aux. Mach. I Study Guide p 63-71
Thermocouples/RTD's	
Week 6: **Piping/ Tubing/ Materials**	
Pipe/Tubing	Aux. Mach. I Study Guide p 105-116
Pipe/Tubing Identification and Materials	Aux. Mach. I Study Guide p 117-120
Pipe/Tubing Pipe Fittings and Joints	Aux. Mach. I Study Guide p 121-137
Piping Problems	Aux. Mach. I Study Guide p 138-145
Week 7: Piping/ Tubing/ Materials	
Pipe/Tubing	Aux. Mach. I Study Guide pp. 105-116
Pipe/Tubing Identification and Materials	Aux. Mach. I Study Guide pp. 117-120
Pipe/Tubing Pipe Fittings and Joints	Aux. Mach. I Study Guide121-137
Piping Problems	Aux. Mach. I Study Guide 138-145
Week 8: Steam Traps	
Steam Traps	DOE Handbook pp 251-255.
	Aux Mach I Study Guide pp 159-172
Week 9: Valves, Gaskets	
Valves Types, Parts and Functions	DOE Handbook pp. 201-250, 394-400
	Aux Mach I Study Guide pp 187u-243
Packing and Gaskets	Aux Mach I Study Guide pp 173-185
Regulating Valves-Spring Loaded	Aux Mach I Study Guide pp 219-231
(Including Reducing Valves)	

Regulating Valves-Air Operated	Aux Mach I Study Guide pp. 233-243
Valve Actuators	DOE pp. 244-250
Week 10: Regulating Valves	
Packing and Gaskets	Aux Mach I Study Guide pp 173-185
Regulating Valves-Spring Loaded (Including Reducing Valves)	Aux Mach I Study Guide pp 219-231
Regulating Valves-Air Operated	Aux Mach I Study Guide pp. 233-243
Valve Actuators	DOE pp. 244-250
Relief and Safety Valves	DOE pp. 240-242
Week 11: Strainers, Heat Exchangers	
Heat Exchangers	DOE Handbook pp 293-310
Strainers	DOE Handbook pp. 256-264
Week 12: Bunkering, Pumps	
Positive Displacement Pumps	DOE Handbook pp. 282-292
Non-Positive Displacement Pumps	DOE Handbook pp 265-281 Aux. Mach. I Study Guide pp 249-275
Bunkering and Bunkering Safety	
Fuel Oil Transfer	
Week 13: Pumps, Fuel Oil	
Positive Displacement Pumps	DOE Handbook pp. 282-292
Non-Positive Displacement Pumps	DOE Handbook pp 265-281 Aux. Mach. I Study Guide pp 249-275
Week 14: Process Control	
Process Control	DOE Handbook pp 341-393
Week 15: Shipboard Operation	

Student Learning Outcomes:

Success in this course will be measured by examining and applying your understanding of the installation, operation, and maintenance of Auxiliary equipment and systems in the Marine Engineering field. Weekly quizzes will be used to measure the learning objectives. Homework will also be given to ensure students meet all learning objectives within this course.

STCW Learning Objectives:

Demonstrate knowledge and understanding of the following STCW elements:

- AB-E-A5.1 Basic knowledge of the function of auxiliary machinery
- AB-E-A5.1 Basic knowledge of the operation of auxiliary machinery
- AB-E-A6.1 Knowledge of oil transfer operations
- AB-E-A6.1 Preparations for fuelling and transfer operations
- AB-E-A6.1 Procedures for connecting and disconnecting fuelling and transfer hoses
- AB-E-A6.1 Procedures relating to incidents that may arise during fuelling or transferring operation
- AB-E-A6.1 Procedures for securing from fuelling and transfer operations
- AB-E-A8.1 Safe operation of valves and pumps
- AB-E-B1.1 Ability to use lubrication materials and equipment
- OICEW-A4.1 Basic construction and operation principles of pumps
- OICEW-A4.1 Basic construction and operation principles of heat exchanges
- OICEW-A5.2 Operation of pumping systems
- OICEW-A5.2 Routine pumping operations
- OICEW-C1.7 Use of various types of sealants and packing
- OICEW-C2.2 Appropriate basic mechanical knowledge and skills
- OICEW-C2.5 Design characteristics and selection of materials in the construction of equipment
- OICEW-C2.6 Interpretation of machinery drawings and handbooks

Learning Objectives:

After this course, the student should be able to:

- Interpret machinery drawings and handbooks
- Interpret piping, hydraulic, and pneumatic diagrams
- Safely operate pumps, valves, and pumping systems
- Conduct routine pumping operations
- Discuss the construction and operational principles of pumps, valves, and heat exchangers
- Discuss the methods of measurement of temperature, pressure, level, and flow
- Perform basic calculations and unit conversions involving system parameters
- Demonstrate basic mechanical knowledge and skill in a workshop environment

The course supports the achievement of the following ABET objectives:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to identify, formulate, and solve engineering problems
- An ability to communicate effectively

Demonstrate proficiency in the following skills:

ABE-1-6A Assist with fuel oil transfer
OICEW-8E2A Make emergency repairs
RFPEW-1H2C Shift and clean a basket-type duplex strainer

Other Objectives:

- Calculate the dimensions of a section of pipe or tubing
- Explain the construction techniques and materials used in a section of pipe or tube
- Identify all pipe fittings used in a fluid piping system
- Describe the types and purpose of various flange connections used in a high-pressure fluid piping system
- Identify the different types of expansion joints used in a liquid piping system
- Discuss the various operational problems associated with fluid piping systems
- Identify the multiple materials used in packing and gasket sealing systems
- Calculate the size of moving shaft packing sizes
- Discuss the importance of the "Lock out-Tag out" safety procedure
- Explain the various methods of renewing fixed gasket joints and the safety concerns involved
- Calculate pressure readings in both the gage and absolute scales
- Calculate pressure readings based on the height of various liquids
- Identify the different pressure-measuring devices
- Calculate temperature readings in both Fahrenheit and Celsius scales
- Discuss the difference between thermometers and pyrometers
- Describe the methods of liquid level measurements. Deep or Ullage soundings
- Identify the various types of valves used in a fluid piping system.
- Demonstrate the use of piping symbols on the system drawings to identify these valve
- Discuss the construction differences in valves used in low- and high-pressure piping systems
- Discuss the troubleshooting of problems associated with valves
- Describe the operation of a spring-loaded pressure-regulating valve
- Demonstrate knowledge of the purpose of the essential parts of a spring-loaded pressure-reducing valve
- Discuss operational problems associated with the failure of various parts of a spring-loaded pressure-reducing valve
- Describe the use of diaphragm control valves in a pneumatic piping system
- Describe the operation of a pneumatically operated pressure-regulating valve
- Discuss the features of a diaphragm control valve regarding whether it is "Fails-Open or Fails Closed."

Student/Instructor Responsibilities:

Instructor will:

- Arrive on time, prepared for class
- Maintain student hours

- Treat students with respect
- Grade all quizzes promptly
- Inform students of any changes to the syllabus

Students will:

- Check email and Blackboard daily
- Arrive on time for class, prepared
- Treat all classmates with respect
- Reach out to the instructor with concerns or questions

Note:

This syllabus is subject to change. Students will be notified if anything changes in the syllabus throughout the course.