Massachusetts Maritime Academy – Department of Engineering
Operational Controls Lab (EN-3216L) in BR-141
Spring 2023

Instructors:

Dr. Ashraf Omran, aomran@maritime.edu, Harrington 210A
Office hours- M-W-F-9 am to 10 am (or by appointment)
Dr./Cdr. John Bausch, jbausch@maritime.edu, Harrington 222A
Office hours- M-W-F-10 am to 11 am (or by appointment)
Prof. Laura Wilcox, lwilcox@maritime.edu, Harrington 212A
Office hours- M-W-9 am to 11 am (or by appointment)

Prerequisites:

Electronics, EN-3212. Must be completed prior to taking this course.
Operational Control, EN-3216. Must be taken concurrently with, or prior to, this course.

Course Description:

This lab provides an opportunity to work with instruments and control hardware found aboard ships and in industry and supplements the content of EN-3216. Students will select, install, and calibrate various sensors and instruments; build and tune PID control loops; design and implement control circuits using Programmable Logic Controllers and Ladder Logic.

Attendance:

Ops Controls Lab meets **EVERY WEEK** in **BR-141** (the OC.Lab).

Attendance is mandatory at all labs. If you anticipate needing to miss a lab, you must contact your instructor as soon as possible and arrange to swap places with a student in another lab section. Missing a lab will result in an Incomplete grade for the course until the lab is made up. Please see the MMA Course Catalog for details about Incomplete grades.

Two or more missed labs will result in a failure (F) for the course.

Course Materials:

- Each student will bring a laptop to class for use in lab result analysis.
- Each student will maintain a 3-ring OLab binder for this course (a 1-inch binder is adequate).
- HANDOUTS will be provided for each lab and should be retained in your OLab binder.
- TEAM RESULTS in each lab should be printed out and stored in your OLab binder
- Supplemental materials may be provided on Blackboard or via Google Drive in the form of videos, PowerPoint presentations, and links to relevant websites (check your Instructor EMail).

Texts and References:

- *Instrumentation and Process Control*, 7th Edition by Weedon, T., Kirk, P., and Kirk, F, American Technical Publishers, 2010
- *Instrumentation for Process Measurement and Control*, 3rd Edition, Anderson, N., 1997
- *Marine Engineering Workbook* 7th Edition
- *DOE Fundamentals Handbook Instrumentation & Controls* Vol 1 & 2

Grading:

Grades determined by ATTENDANCE	(30%)
Completion of the weekly homework	(30%)
A weekly OLab-QUIZ	(20%)
An OLab FINAL Lab REPORT	**(20%**
OLab TOTAL Lab GRADE SCALE =	100%

Grades will be assigned based on a standard 100-point scale. Letter Grade Cut-Offs:

93 ≤ X ≤ 100 A	80 ≤ X ≤ 82 B−
90 ≤ X ≤ 92 A−	77 ≤ X ≤ 79 C+
87 ≤ X ≤ 89 B+	73 ≤ X ≤ 76 C
83 ≤ X ≤ 86 B	70 ≤ X ≤ 72 C−

Note:

This is a 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 earn a grade of F and have to repeat the course.

Dress Code:

All regimental cadets are required to be in the uniform of the day.

Food & Drink:

No food and drinks are allowed in the classroom except for water in a closed container.

Class Policy:

Labs are a collaborative learning environment and require teamwork among students.
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 cell phone which 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.

Honesty:

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

Disability Accommodation:

Massachusetts Maritime Academy 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 the Director of Disability Compliance.

ADA Coordinator: Dr. Elaine Craghead, Asst. Dean
ABSIC 320
X5120 (Karen Nahigian)
ADAcompliance@maritime.edu

STCW Requirements:

- OICEW-A4.1 Basic construction and operation principles of automatic control systems
- OICEW-A5.1 Operational characteristics of control systems
- OICEW-B1.1 Basic configuration and operation principles of sequential control circuits and associated devices
- OICEW-B1.2 Flowchart for automatic and control systems
- OICEW-B1.2 Functions, characteristics, and features of control systems for machinery items
- OICEW-B1.3 Various automatic control methodologies and characteristics
- OICEW-B1.3 Proportional–Integral–Derivative (PID) control characteristics
- OICEW-B1.3 Associated system devices for process control
- OICEW-B2.5 Function and performance tests of electrical and electronic monitoring systems
- OICEW-B2.5 Function and performance tests of electrical and electronic automatic control devices
- OICEW-B2.5 Function and performance tests of electrical and electronic protective devices
- OICEW-B1.3 Configuration and operation principles of control systems

Learning Objectives:

On completion of this course, the student should be able to:

- Use and put together different process control system components.
- Use a calibrator to actuate the control valve.
- Calibrate different types of temperature, pressure, level, and flow measurement devices.
- Use a paperless recorder, HMI, and PLC in recording data and tune controller gains.
- Identify dynamic characteristics of a process from the step response.
- Implement ON/OFF and PID control for different control systems using PLC and paperless recorder.
- Tune PID gains using Ziegler-Nichols for different process control systems.
- Build and read a P&ID for a process control system.
- Build and read a block diagram for a process control system.
- Follow the safety procedure for the operational control systems.

Course Progression:

- OLab01: Introduction to the Lab Equipment
- OLab02: Pressure Measurement, Exercise 3-1
- OLab03: Flowmeters, Exercise 4-1
- OLab04: Differential-Pressure Level Meters. Exercise 5-1
- OLab05: Bubblers, Exercise 5-2
- OLab06: Wet Reference Leg, Exercise 5-3
- OLab07: Determining the Dynamic Characteristics of a Process, Exercise 1-1
- OLab08: Thermocouple and RTD
- OLab09: Tuning and Control of a Pressure Loop, Exercise 2-1
- OLab10: Tuning and Control of a Level Loop, Exercise 2-2
- OLab11: Guided Process Control Troubleshooting, Exercise 3-1

Our Provost canceled Thursday, April 19th, 2023, morning classes because one of our cadets passed away. To keep the lab in sync, we had to cancel one of our labs; i.e. teaching 11 labs instead of 12 labs.

Note:

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