Steam & Gas Turbine EN-3233

Spring 2022

Instructor: LT K. McClellan, EdD

Office: Room 215A Harrington

E-Mail: kmcclellan@maritime.edu

I will try to respond to all emails within 48 hours.

Student Hours: Tuesday 1100-1300, Wednesday 1300-1400, or by appointment either in-person or via Zoom

COVID-19:

If we have to move to an on-line 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.

Prerequisites:

Calculus I and Steam Generators

Text:

Modern Marine Engineer's Manual, Vol. 1 (Osbourne or Hunt)

Engineering Training Manual TS Kennedy (Haynes)

Marine Engineering Workbooks, Vol. 1, 2, and 3 (Haynes)

Handouts will be distributed during class lectures and lab instruction

Awareness:

- If a cell phone is seen in class, it will be taken and given to the Undergraduate 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 a calculator.
- No smart watches may be used in class, during quizzes, or on the final exam.
- Once class starts, if a cadet leaves the room, he/she will not be allowed back into the class.
- No food or drink allowed in the classroom except bottled water.
- All COVID-19 protocols and policies will be followed.

Course Description:

EN -3131 covers the principles, design, operation, maintenance, and repair of marine steam turbines and gas turbines, including their reduction gears, thrust bearings, couplings, governors, and lubrication systems. Line shaft bearings and propellers are other topics included. [Lab time required]

Entrance Requirements:

- Locate and identify all the components relating to the training ship's main propulsion plant.

- Understand and utilize the Mollier chart and steam tables.
- Thoroughly understand the operation of the training ship's boilers.

Attendance:

- Attendance is mandatory for all class lectures and lab instruction. Special liberties DO NOT COUNT as excused.
- The only excused absences are for mandatory academy activities.
- Students with perfect attendance will have their lowest quiz grade dropped. There will be **NO** make-up quizzes offered even with an excused absence and **NO QUIZZES WILL BE DROPPED without perfect attendance**. Missing a quiz equals a **ZERO.**
- For each unexcused lecture absence, the final grade will be reduced by 2 percent.
- Lab instruction classes are Mandatory. Disciplinary action will be taken if needed. An "Incomplete" grade will be issued if all labs are not completed.
- **Students who miss three (3) or more classes will automatically fail the course.**

Grading:

Quizzes	60%
Tests	25%
Lab	10%
Homework/Participation	5%

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- (70).

Homework:

Homework is a key part in your learning. You are expected to do all homework/reading assignments. Please keep a notebook with all work. Most homework assignments will be posted in Blackboard and will also be turned in on Blackboard.

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 allowed; however, they must be clean and with no holes.

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 studio 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.

Electronic Devices:

No electronic devices will be allowed in this class. The only device that can be used is a non-programable 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.

Blackboard:

Blackboard will be used to enhance the overall course content. It will be used to upload lectures, handouts, and videos. It is up to you to check your blackboard for material and to make sure you can log in.

Labs:

All Engineering Labs must be attended and completed to the satisfaction of the lab instructors to receive a final grade in this course. You must show up with all your PPE.

Due to COVID-related reductions in lab space capacities and significant scheduling limitations, this creates the situation that students will not be able to make up missed in-person labs. The expectation for this course is that you will attend all labs at the scheduled time. Missed in-person labs cannot be made up nor incompletes given as a result of missed labs. If you miss a lab(s), your course grade will be impacted and may result in a failing grade; and you may be advised to withdraw from the course.

Disability Accommodation:

ADA Coordinator: Dr. Elaine Craghead, Asst. Dean

ABSIC 320
X5120 (Karen Nahigian)
ADAcompliance@maritime.edu

Fundamentals of steam turbines, thermodynamics, Rankine cycle

1. Mollier chart and steam table problems
2. Turbine design – impulse, reaction, Curtis, Rateau, etc.
3. Steam turbine main engine construction, gland sealing steam, turbine losses
4. Auxiliary plant steam turbines, turbogenerators
5. Lube oil – lube oil systems, lube oil purification
6. Reduction gears, gears, couplings
7. Bearings – turbine bearings, line shaft bearings, stern tube bearings

8. Governors, control systems, turbine control
9. Main plant start-up and shut-down
10. Principles of gas turbine, thermodynamics, Brayton cycle
11. Gas turbine design and performance
12. Gas turbine compressor, combustors, & turbines
13. Gas turbine systems auxiliary equipment: starting systems, fuel systems, lube oil systems
14. Main engine propulsion and gas turbine auxiliaries
15. Gas turbine inspection, maintenance, and repair
16. Propellers
17. Steam turbine and Gas turbine plant operation and Casualty control

Reading Assignments:

- Chapter 1 – Thermal Sciences and Engineering 1-1 thru 1-47
- Chapter 3 – Steam Power Plants 3-1 thru 3-42
- Chapter 6 – Marine Steam Turbines 6-1 thru 6-58
- Chapter 4 – Bearing Application and Lubrication 4-1 thru 4-86
- Chapter 7 – Gas Turbines 7-1 thru 7-104
- Chapter 8 – Gas Turbine Fuels 8-36 thru 8-39
- Chapter 9 – Mechanical Transmission Systems 9-1 thru 9-63
- Handouts as needed (Posted on Blackboard)

Reading assignments could change depending on pace of class.

Student Learning Outcomes:

Success in this course will be measured through examination and application of your understanding of the design, construction, and operation of marine boilers.

Learning Objectives:

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

- Demonstrate basic construction and operation principles of marine steam turbines.
- Demonstrate basic construction and operation principles of marine gas turbines.
- Communicate basic construction and operation principles of shafting installations, including propellers.
- Indicate basic construction and operation principles of purifiers.

- Develop an understanding of the major components of a turbine and what their specific functions are.
- Understand the theories of the basic principles of impulse and reaction design.
- Provide a detailed explanation of the theory and construction of gas turbines.
- Develop an understanding of how a steam turbine differs from a gas turbine.
- Understand fundamental thermodynamics, steam tables, and Mollier chart.
- Satisfy the USCG requirements of standards of training, certification, and watchkeeping (STCW) for the skill sets developed during the lab and lecture portions of this course.

STCW Learning Objectives:

Learning Objectives

Demonstrate knowledge and understanding of the following STCW elements:

- OICEW-A4.1 Basic construction and operation principles of marine steam turbines
- OICEW-A4.1 Basic construction and operation principles of marine gas turbines
- OICEW-A4.1 Basic construction and operation principles of shafting installations, including propellers
- OICEW-A4.1 Basic construction and operation principles of purifiers

Student/Instructor Responsibilities:

Instructor Will:

- Arrive on time, prepared for class
- Maintain student hours
- Treat students with respect
- Grade all quizzes in a timely manner
- Inform students of any changes to 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 does change in the syllabus throughout the course.