EN-3111 ELECTRICAL MACHINES Spring 2025

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Course Website: https://weh.maritime.edu/EN-3111

OFFICE HOURS

Tuesdays and Thursdays 0830-1000 or by appointment.

COURSE DESCRIPTION

Students study AC and DC theory as applied to motors, generators, and power distribution systems. The course also considers preventive maintenance and repair of rotating and static electrical equipment; electric drive principles and operation; and U.S. Coast Guard electrical engineering rules and regulations. The lab component covers ship and shoreside machinery.

LEARNING OBJECTIVES

To provide the student with an operational understanding of power systems, motors, and generators including single and three phase AC systems, DC systems, and storage batteries. At the conclusion of the course, the student should be able to demonstrate:

- Distinguish between single and three phase systems
- Provide an electrical load analysis of an AC system
- Mathematically correct the power factor of an AC system
- Define the differences in various types of transformers and compute electrical loads on them
- Describe the design and operation of electric generators, including single and three phase AC generators and DC generators
- Describe the methodology for correctly paralleling two AC generators and balancing the electrical loads on each
- Describe the construction, maintenance, and operation of motor controllers

DEMONSTRATE KNOWLEDGE AND UNDERSTANDING OF THE FOLLOWING STCW ELEMENTS

- OICEW-B1.1 Basic configuration and operation principles of electrical generators
- OICEW-B1.1 Basic configuration and operation principles of electrical distribution systems
- OICEW-B1.1 Preparing, starting, paralleling and changing over generators
- OICEW-B1.1 Basic configuration and operation principles of electrical motors
- OICEW-B1.1 Electrical motor starting methodologies
- OICEW-B1.1 Basic configuration and operation principles of high-voltage installations
- OICEW-B2.1 Safety requirements for working on shipboard electrical systems
- OICEW-B2.1 Safe isolation of electrical equipment required before personnel are permitted to work on such equipment
- OICEW-B2.2 Maintenance and repair of electrical system equipment
- OICEW-B2.2 Maintenance and repair of electrical switchboards
- OICEW-B2.2 Maintenance and repair of electric motors and generators
- OICEW-B2.2 Maintenance and repair of DC electrical systems and equipment
- OICEW-B2.3 Detection of electric malfunctions
- OICEW-B2.3 Location of faults causing electrical malfunctions
- OICEW-B2.3 Measures to prevent damage caused by electrical malfunctions
- OICEW-B2.4 Construction of electrical testing and measuring equipment
- OICEW-B2.4 Operation of electrical testing and measuring equipment

ENTRANCE REQUIREMENTS

- Successful completion of SM-2224 Engineering Physics II
- Describe and use the fundamental concepts of electrical circuits as taught in Engine Physics II
- Solve simple circuits using Ohm's Law and Kirchhoff's Law
- Describe Faraday's Law of Electromagnetic Induction

CLASS CALENDAR

Visit https://weh.maritime.edu/EN-3111 for the course website which contains the predicted schedule, quiz and exam dates, reading and homework assignments and other useful information. This calendar is my best estimate of how the class will progress, but is subject to change, and will be updated accordingly (with notice).

REQUIRED READINGS AND VIDEO

Reading assignments and recommended videos will be posted on the course website, and will include readings from Operating, Testing, and Preventative Maintenance of Electrical Power Apparatus by Charles I. Hubert, and other relevant materials.

BLACKBOARD

Quiz, Exam, and Homework Grades will be posted on blackboard. Calculate your own grades averages based on the weightings given below.

ATTENDANCE POLICY

This course is governed by STCW rules and regulations.

Attendance is required for all labs and lectures in this course. For the lecture portion of the course a student may miss only 10% (up to a maximum of 4 lectures) before they are ineligible to complete the course.

Students will be rewarded for perfect attendance. For a perfect attendance record, the lowest quiz grade will be dropped.

Students will be penalized for an unexcused absence. Please inform me before the start of class by email, that you will be unable to attend class and the reason. If no prior notice is given by that student, the absence will be considered "unexcused" and there will be a 2 point deduction from his or her final grade for each unexcused absence.

Attendance includes being present at the beginning of class. Quizzes are typically given at the beginning of a class lecture and students will not be permitted to take the quiz or permitted into the classroom if they are tardy. Tardiness of more than 10 minutes will be considered an unexcused absence. Absences that are given prior notice will not be penalized, but the student will not be allowed to drop his or her lowest quiz grade at the end of the semester. If the absent student is on a MMA sanctioned activity that includes an athletics event, MMA school-sponsored event, or Armed Forces duty / training, AND has discussed this prior to the absence with the instructor, he or she may still be eligible for perfect attendance.

NOTEBOOK

Students are encouraged to take notes in lecture & lab and keep an organized three-ring binder. This notebook may be admissible for use as reference during some quizzes, so a better organized notebook can suffice as its own reward.

SUBJECT MATERIAL AND READING ASSIGNMENTS

Course reading assignments and subject material covered will be assigned by the instructor on a class-by-class basis. Reading assignments will be posted on the courses webpage, and/or assigned during class. All reading assignments are pertinent material and subject fair game for quizzes, exams, and homework.

HOMEWORK ASSIGNMENTS

Homework is made up of two parts, each worth 10% of the course grade: end of chapter **Questions** and **Numbas** randomized problems. In total homework assignments account for 20% of a student's grade, and it is easy to earn high scores on the homework by completing it on time and submitting good work. The more effort put forth the greater the successful result.

Question HW will be handed in at the start of class on quiz days. Late Question HW will be accepted at the following class for half credit. Emailed submissions will not be accepted.

Format: Homework submissions must be legible, on 8.5 x 11 inch plain paper, not torn from a notebook, and stapled if more than one sheet. Each submission must have a page heading including the student's name, assignment number, and Due Date.

Content: Homework submissions must be hand-written original work, using complete sentences with correct spelling and grammar. Do not use AI Tools to formulate your answers, however you may copy directly from the textbook if quoted and credited. Homework assignments will be graded on effort and completeness including any diagrams or sketches requested.

Numbas HW is due on quiz days, and you should expect similar problems on the quiz that day. Numbas HW will "close" at midnight on the due date. Numbas provides infinite attempts without penalty so you should strive to get 100% on every Numbas assignment. Your Numbas score will be expressed as a percentage of the possible points.

DRESS CODE

Dress code will be uniform of the day as announced by the Commandant of Cadets Department. If students are returning from lab they are expected to change before the beginning of class. No Boiler Suits allowed in class. No Exceptions.

CELL PHONE & SMART TECHNOLOGY POLICY

Cell phones and internet-capable technology are prohibited during class. These instruments must be silenced and out of view at all times. Usage during class will result in authorized confiscation to the dean's office. Programmable calculators are permitted in class, but may not be allowed during exams. Non-programmable calculators are welcome at all times.

FOOD, DRINKS, & LAVATORY USAGE DURING CLASS

Please refrain from bringing any kind of food or drink into the classroom. Please refrain from using the lavatory during class.

SPECIAL LIBERTY POLICY

Please do not ask the Instructor to sign a special liberty request. The only special liberties recognized by the engineering department are those of an emergency nature which are granted directly by the Commandant of Cadets office.

LEARNING DISABILITIES

Massachusetts Maritime Academy is committed to providing academic accommodations to students who qualify. Students who had 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 Craighead, 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 ADAcompliance@maritime.edu or at x5350.

GRADING Your final grade will be comprised as follows.

Weekly Lecture Quizzes	30%
Final	25%
Midterm Exam	25%
Question Homework	10%
Numbas Homework	10%

GRADING SCALE

Please note that the minimum passing grade for this course is 70% due to the requirements of STCW. The course grading will be broken down as follows:

A: 95-100	**B+: 87-89.9**	**C+: 77-79.9**	
A-: 90-94.9	**B: 83-86.9**	**C: 73-76.9**	**F: < 70**
	B-: 80-82.9	**C-: 70-72.9**	

ACADEMIC DISHONESTY – PLAGIARISM

Plagiarism: According to the *Oxford English Dictionary* means, "to take and use as one's own." This means taking and using the writing, ideas or work of another person and passing it in as your own work. Some of the most common forms of plagiarism are:

- Using AI tools such as ChatGTP, Copilot, Grammarly to do the research and writing for you.
- Cutting and pasting sentences and/or paragraphs from web sites
- Turning in another student's work as your own with or without the student's knowledge
- Turning in work that another student, friend, family member, etc. has written for you
- Copying directly from a source (book, magazine, Internet, etc.) without using quotations marks and giving credit to the author
- Copying directly from a source without using quotation marks and changing a few words. This does not make the work your own. Example: Changing the original word "asked" to "questioned"
- Paraphrasing or summarizing (putting someone else's words, ideas or work into your own words) without giving credit to the source
- Using any parts or all of a PONY (pass on to next year) file (including graphs, tables, etc.-)

Avoiding Plagiarism: The main way to avoid plagiarism is to give credit to the sources you have used. You can do so by quoting directly, summarizing or paraphrasing. **In ALL cases, you must give credit to the author and/or source.** Depending on the assignment you are given, this may include a bibliography or works cited page. Always check with your instructor or professor to find out how this should be done in the particular discipline.

If you are not sure if you are plagiarizing from an outside source, you can always check with one of the Humanities professors regardless of the course in which the assignment is due. We are always willing to help students with any and all writing problems or concerns for any course, not just those in the Humanities Department. You may also go to the Writing Resource Center or the Academic Resource Center for help.

Remember: any student committing an act of plagiarism will face consequences such as failing the project or the course. In addition, you may be reported to the academic dean for further action and possible suspension or expulsion from the school.

Homework Requirements

Homework consists of two types of assignments: **Questions** and **Problems**. Both parts are due and will be collected at the on the day of the next quiz. All assigned questions and problems must be attempted for full credit and only the handwritten work submitted in class will count.

The short-answer **Questions** are posted on blackboard. Submissions must be neat, legible, and include the problem statement. The submitted questions will be graded on effort and completeness including any diagrams or sketches requested in the problem or question. Points will be deducted for incomplete submissions.

The numeric **Numbas problems** are also available on Blackboard. These problems are randomly generated, and each student's problems will be unique. The Numbas problems will tell you when you are correct. Your score reported by Numbas is for your information only.

See the syllabus for the complete homework policy, including the late policy.

Numbas Tips

- You will need to download and use the Numbas Lockdown Browser to access the homework. https://www.numbas.org.uk/lockdown-app/
- Mac users may need to grant permission to install the software. See https://www.numbas.org.uk/lockdown-app/mac_security.html
- Answers must be accurate to three significant digits and include correct units.
- Units require proper capitalization. kW not kw or KW; horsepower or hp, not HP, etc.
- For angles, use a degree symbol ° (shift-option-8 on mac) or type *deg*.
- Greek letter π (option-p on mac) can be entered by typing "pi".
- Include a leading zero for numbers like 0.25 or -0.5.
- If you feel that a problem is not working properly or returning the wrong answer, take a screenshot of the problem/answer and let me know so that I can fix it.

Units

Most units are acceptable. Below are some which you may use for electrical problems.

The complete list of accepted units is at: https://numbas.mathcentre.ac.uk/extensions/55/documentation.

Electrical Units

- %, percent
- A, Ampere, amp, ampere, amps
- Ah
- C, Coulomb, coulomb
- d, day, days
- dB, decibel, decibels
- deg, degree, degrees
- dyn, dyne
- F, Farad, farad
- h, hour, hours, hr, hrs
- horsepower, hp
- J, Joule, joule, joules
- lbf, pound-force
- min, mins, minute, minutes
- N, Newton, newton
- Ohm, ohm, Ω
- rad, radian, radians
- rotation
- rpm
- s, sec, second, seconds, secs
- S, Siemens, siemens
- T, tesla, teslas
- V, Volt, volt, volts
- VA, volt-ampere
- VAR, VAr, Var, var, volt-ampere-reactive
- W, watt, watts
- Wb, weber, webers
- Wh

Prefixes

- M, Mega, mega
- k, kilo
- Centi, c, centi
- Milli, m, milli
- Micro, mc, micro, u, μ, μ
- Nano, n, nano

Note: Numbas has no conception of a "turn," so MMF units *ampere-turns* are submitted as *ampere, etc.*