

EN 3111
Electrical Machines

Instructor:

Dr. Matthew H. Kane
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Office Hours: MWF 1300 – 1400 or by appointment

Textbook:

Charles I. Hubert, *Operation, Testing, and Preventive Maintenance of Electrical Power Apparatus* (2003). ISBN 0-13-041774-2

Overview:

Electrical machines are devices which convert between electrical energy to mechanical energy and are used extensively in power generation, industrial, and maritime applications. This course covers the theory, operation, on maintenance of these devices. Students will study AC and DC theory as applied to motors, generators, transformers, and power distribution systems.

Learning Objectives:

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

Prerequisites:

1. Engine Physics II (SM2224)

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1. *Capacitance, Inductance*
2. *DC and Single Phase AC circuits*
3. *Phasors*
4. *Power Factor*
5. *Three phase systems*
6. *Transformers*
7. *Three phase induction motors*
8. *Synchronous motors*
9. *3 phase motor operation*
10. *AC Generators*
11. *Single phase AC motors*
12. *DC Generators*
13. *DC Motors*
14. *Battery Systems*

Grading:

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|------------------------|-----|
| 1. In-class Activities | 20% |
| 2. Problem Sets | 10% |
| 3. Quizzes | 15% |
| 4. Midterm Exams (x2) | 15% |
| 5. Final Exam | 25% |

In-class activities will be conducted both on-paper and using the remote i-clicker system. All students are expected to remain current on the topics covered in the course and participate in these activities. These activities are graded predominantly for participation.

Two 1 hour exams will be give during the semester. A comprehensive final examination will be given during the final examination period.

Problem sets will be given at the rate of roughly one or the other per week in those weeks not having an exam. These are intended to provide reinforcement or augmentation to the concepts covered in class. Homework will be graded on a “cliff” grading system: 10 pts for complete and

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correct homework, 9 pts for complete assignments with only minor errors, 7 pts for complete assignments with significant errors, and 4 pts for attempted but partially complete homework.

In addition, quizzes (announced or unannounced) will be given at the rate of roughly one per week. No make ups will be given for quizzes or in-class activities.

An overall grade of 90% will receive an A, 80% a B, 70%, a C.

STCW Policy:

As Electrical Machines is an STCW required course, a minimum of a “C” is required to pass the course and receive STCW credit

The following STCW knowledge components are covered in this course:

1. Basic configuration and operation principles of electrical generators and electrical motors and electrical distribution systems (OICEW-B1.1)
2. Preparing, starting, paralleling and changing over generators and motors(OICEW-B1.1)
3. Safe isolation of electrical equipment and Safety requirements for working on shipboard electrical systems(OICEW-B2.1 1)
4. Maintenance and repair of electrical system equipment, electrical switchboards, electric motors and generators, and DC electrical systems and equipment (OICEW-B2.2)
5. Detecting electric malfunctions, locating faults, and preventing damage caused by electrical malfunctions (OICEW-B2.3)
6. Construction and operation of electrical testing and measuring equipment (OICEW-B2.4)

Attendance:

Classroom attendance is expected of all students involved in the course. One unexcused absence will be forgiven. After that, each unexcused absence will lower the student’s final course average by two points for each additional absence. Excessive absences may be referred to the regiment for additional discipline.

Wireless devices:

Cellular telephones, tablets, or laptops may be used in this course for the i-clicker application and activities which support the learning process only. Any equipment used in class for unauthorized purposes will be confiscated and turned over to the academic dean and referred to the regimental staff for additional disciplinary measures.

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Calculator Policy:

Only non-programmable calculators may be used on exams and quizzes in this class.

Uniform Policy:

Regimental students are expected to be present in class in the uniform of the day. Boiler suits or leisure attire is not allowed.

Email policy:

Students are expected to remain current with their maritime email account for the transmission of information pertinent to the course. Course notes and grades will be posted on the Blackboard system.

Honor Code:

All students are expected to abide by the Massachusetts Maritime Academy Cadet honor code. Violations of the honor code will be dealt with strictly, including failure of the course.

Homework:

Students will be assigned homework on approximately a weekly basis throughout the semester. Homework must be turned in during the class period the date that it is due: no late homework will be accepted. Students are encouraged to work in groups to complete the homework assignments, but the homework that is turned in must represent the individual effort of the student.

Disability Accommodations:

Any student in this course who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact the Director of Disability Compliance and the instructor as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate your educational opportunities.

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