

Electrical Machines

EN-3111

Instructor: Art Torino
atorino@maritime.edu

Room: 216A Ext: 2075
Office Hours: MWF 1PM 2PM
and by appointment

Text: Operating, Testing, and Preventive Maintenance of Electrical Power Apparatus,
Charles I. Hubert, PE, Prentice Hall

Prerequisite: SM-2224 Engineering Physics II

- Describe and use the fundamental concepts of dynamics as taught in Engine Physics II
- Solve simple circuits using Ohm's Law and Kirchoff's Law
- Describe Faraday's Law of Electromagnetic Induction

Course Description

Students study AC and DC theory as applied to motors, generators, and power distribution systems. The course also considers preventative maintenance and repair of rotating and static electrical equipment; turboelectric drive principles and operation; and U.S. Coast Guard electrical engineering rules and regulations. The laboratory component covers ship and shore side 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 must be able to:

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
- Describe the principles of operation of electrical machinery typically found on ships
- Calculate circuit properties such as current, voltage, power, and power factor for single and three phase AC circuits
- Describe the conditions necessary to parallel AC Generators
- Describe why power factor correction is desirable, and how it is accomplished
- Describe the effects of resonance on electric circuits

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Grading:

- Participation: 10%, Quizzes: 30%, Tests: 30%, Final Exam 30%
- A quiz will be given at the beginning of class each Monday and will be based upon the homework assignments for the week. Make-up quizzes are not given. Make-up test for tests or final are considered only for extraordinary circumstances.
- Homework is not collected nor graded.
- Attendance is mandatory; each unexcused absence may result in a two point deduction from the final course grade.
- Electrical Machines is an STCW required course. For all students a minimum grade of C- (70%) is required for STCW credit and to pass the course. Engineering Physics II is a prerequisite for the class.

Attendance:

Attendance is mandatory. You are permitted one (1) unexcused absence without penalty. For each additional unexcused absence, your course grade will be lowered by two (2) points. For an absence to be excused, you must 1) notify me in advance, and 2) provide written documentation justifying your absence. Both criteria must be satisfied for the absence to be excused. Having watch is NOT a valid excuse for missing class.

Unexcused tardiness and leaving class after its begun are prohibited. Students may leave class at any time; however they will not be allowed to return.

Cell Phones:

Cell phones are NOT permitted in class. If your cell phone rings, beeps, vibrates, etc. or you use your phone for anything (including text messaging) at any time during class, it will be confiscated and delivered to the Academic Dean. **First offense:** you will be dismissed from class (even if it is during an exam). **Second offense:** you will be dismissed from class and your final grade will be lowered by one FULL letter grade. **Third offense:** You will fail the course.

As you can see, it is probably best to just leave your cell phone in your dorm room.

Calculators:

Only non-programmable calculators are allowed in this class. Uses of programmable calculators, including TI-83, TI-84, or similar type calculators are expressly prohibited. Additionally, any electronic devices that can communicate with devices, including other calculators, cell phones, or other communication equipment are prohibited.

DO YOUR HOMEWORK:

Those who do their homework tend to do well in this course. Although homework is not collected or graded, quizzes and tests are based on the homework assignments and some questions will be taken directly from assignments.

Disabilities:

Students with documented disabilities will be afforded appropriate accommodations. Students entitled to additional time on exams must make arrangements with me in advance. If you have a disability and feel you will need accommodations in order to complete course requirements, contact Director, Disability Compliance and Affirmative Action.

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Attire:

All regimental cadets shall be in the proper uniform of the day during class. Boiler suits or other work uniforms are never authorized in class. Non-regimental students are expected and required to maintain a business casual attire.

Health:

MMA Health Services realizes that students may encounter situations which could impede their academic, personal and social development and success. Counseling services are designed to help students address these concerns, increase their self-awareness and empower them to manage challenging areas in their lives. To schedule a confidential appointment please email kshineobrien@maritime.edu or call ext. 1480.

Syllabus

1. Current, Voltage, Resistance
2. DC Circuits and Circuit Faults
3. Magnetic Fields and Circuits
4. Basic Magnetic Circuit
5. Energy in a magnetic field
6. Capacitors
7. Current, Voltage, and Impedance
8. Resonance and Harmonics
9. Power Factor
10. Three Phase Systems
11. Transformers
12. Three Phase Induction Motors
13. Synchronous Motors
14. 3 Phase Motor Operation
15. AC Generators
16. Single Phase AC Motors
17. DC Generators
18. DC Motors
19. Battery Systems
20. Grounding

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Chapters 1, 2, and 3

Current, Voltage, Resistance, Insulation and Conductors, DC Circuits, Magnetic Fields and Magnetic Forces

Ch 1 – Problems 1, 5, 9, 13, 17, 21, 25

Ch 2 – Problems 1, 5, 9, 13, 17, 21, 25, 29, 33, 37

Ch 3 – Problems 1, 2, 3, 4, 5

Chapters 4, 5 Magnetic Circuits and Inductance, Capacitors

Ch 4-5 Odd Problems

Chapter 6 Current, Voltage and Impedance in Single-Phase Systems

Ch 6 Odd Problems

Chapter 7 Resonance, Harmonics and their Harmful Effects

Ch 7 All Problems

Chapter 8 Active, Reactive and Apparent Power in the Single-Phase System

Ch 8 Odd Problems

Chapter 9 Current, Voltage, and Power in the Three-Phase System

Ch 9 Odd Problems

Exam 1 Chapters 1 Thru 7

Chapter 10 Transformers

Ch 10 Problems 1-15 Odd

Chapter 11 Three-Phase Induction Motors

Ch 11 Odd Problems

Chapter 12 Synchronous Motors

Ch 12 Review Questions 1-11

Chapter 13 Operational Problems of Three-Phase Motors

Ch 13 Odd Problems

Exam 2 Chapters 10 thru 13

Chapter 14 Synchronous Generators: Principles and Operational Problems

Ch 14 Odd Problems

Chapter 16 Single-Phase Induction Motors

Ch 16 Review Questions 1-13 and Problems 1, 2

Chapter 17 Direct Current Generators: Principles and Operational Problems

Ch 17 Problems 1-8

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Chapter 27 Operation and Maintenance of Battery Systems

Chapter 28 Bonding, Grounding, Earthing and Ground Fault Protection

Notes:

1. Students are responsible for all review questions in each chapter
2. The syllabus is a working document and depending on the speed of the class we may do slightly more chapters or slightly less. Any change or adjustment to the syllabus will be clearly communicated.

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Academic Calendar Fall 2015

2015 Fall Term (73 Days)

Wednesday	2 September	Commence Classes
Monday	7 September	Labor Day – No Classes
Tuesday	8 September	Last Day to Add Classes
Tuesday	22 September	Last Day to Drop Classes
Monday	12 October	Columbus Day - Holiday, No Classes
Tuesday	13 October	Observe Monday Academic Schedule
Tuesday	20 October	Deficiencies due to Registrar by 1000
Tuesday	10 November	Last Day to Withdraw from Classes
Wednesday	11 November	Veterans' Day - Holiday, No Classes
Tuesday	24 November	Commence Thanksgiving Break after Last Class
Wednesday	25 November	Thanksgiving Break Travel Day
Monday	30 November	Resume Classes
Friday	11 December	End Academics (All Classes)
Monday	14 December	Begin Final Examinations (All Classes)
Friday	18 December	Last day, Final Examinations