

**Instructors**

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**Course Goal**

The purpose of the Electrical Machine Lab is to increase your understanding of the theory, design, construction, operation, and maintenance of electrical machinery commonly found aboard ship and in industrial facilities.

You will develop practical electrical skills such as using electrical measuring equipment, reading schematic diagrams, wiring circuits, troubleshooting faulty circuits, and following safe working practices. Additionally you will verify electrical theory by making measurements of electrical machinery in operation.

The material covered in the laboratory supplements the material studied in *EN-3111 Electrical Machines* and it is assumed that anyone taking the laboratory has either passed this course or is taking it concurrently with the lab. Three STCW skills will be demonstrated during the lab.

**Learning Objectives**

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

- Measure voltage, amperage, and resistance with a DMM
- Measure amplitude, frequency, period and phase shifts of sine waves using an oscilloscope
- Measure wattage, vars, va, and power factor using a power meter
- Measure insulation resistance with a megohmmeter
- Lock-out and tag out electrical circuit s
- Wire a three-way lighting circuit
- Understand the difference between grounded and ungrounded electrical distribution systems
- Connect three phase transformers in delta and wye configurations, and describe the resulting voltage and current relationships
- Demonstrate the operating characteristics of three phase induction motors
- Demonstrate the operating characteristics of single phase motors
- Demonstrate the operation of unloaded and loaded synchronous generators
- Parallel a AC Generator with the bus or another generator
- Demonstrate the operating principles of two-wire and three-wire control circuits
- Demonstrate the operating principles jogging and breaking circuits
- Demonstrate the operating principles reduced voltage and soft starters
- Wire single- and three-phase motors to UVR and UVP motor controllers
- Describe the operation and troubleshoot a magnetic motor controllers
- Understand a thermal overload relay
- Understand sustained overload protection and interrupting capacity
- Demonstrate proficiency in the following STCW elements:
  - OICEW-3-1A Plan and use test equipment
  - OICEW-3-1B Troubleshoot electrical motor control system
  - OICEW-7-1E Parallel generators

## Schedule

This course meets for two hours every week and consists of twelve lab exercises. Six are conducted in the upstairs laboratory and six are conducted in the downstairs lab. At each class meeting students will complete one upstairs or one downstairs lab.

The laboratory schedule is posted on the course website. It is critical that you make every effort to come to your scheduled lab to all sections are filled to capacity. If you must miss a lab due to unavoidable circumstances, you may attend another session of the same lab if space is available, however you are only guaranteed a space at your scheduled lab.

## Technology

The course website at <http://weh.maritime.edu/juice> is where you can find important information and policies regarding the course. The instructors use this site to maintain communications with the class. You should check this site weekly, or you may subscribe to its *RSS feed* using a newsreader to be notified whenever there are new posts. A number links to interesting electrically related websites are also found here.

## Homework

Part of your grade will be determined by your score on the Simutech **Troubleshooting Simulator**. Instructions for connecting to the simulator and more details about the assignment are found on the course website at <http://weh.maritime.edu/juice/troubleshooting>. Read this info and create an account before you come to lab 2.

### Troubleshooting Homework Deadlines

September 23 Create your Account

October 26 Complete all 12 Basic and Advanced Faults

## Quizzes

Quizzes will be given at the end of each lab, worth 50% of your course grade. Quizzes will not be returned.

## Textbook

You will receive a lab manual during the first class meeting. This manual will be used in every lab, so always bring it with you. Review each lab before you come to the lab.

The Electrical Machines course textbook, *Operating, Testing, and Preventive Maintenance of Electrical Power Apparatus*, by Charles I. Hubert, and *Electrical Machines, Drives, and Power Systems*, by Theodore Wildi are also recommended.

## Attendance

Students will be penalized as follows for absences:

Miss 1 lab	Course Grade reduced by 1 Letter Grade
Miss 2 lab	Course Grade reduced by 2 Letter Grades
Miss 3 or more	Automatic course failure

## Grades

Your final grade will be determined using the following weights

Troubleshooting Software	25%	Penalties may be applied for missing deadlines.
Upstairs Lab Quizzes	25%	
Downstairs Lab Quizzes	25%	Lab final will be held preceding course final exam.
Lab Final Exam	25%	
Attendance Deduction	See above	

**STCW Assessment**

This lab addresses the STCW Function: *Electrical, electronic and control engineering at the operational level*. All students are required to satisfy the STCW assessments of the course.

Students who fail to demonstrate competence in all of these areas will receive an *Incomplete* for the course. You can clear an *incomplete* by demonstrating the missing competencies. Make up labs and assessments will be held during the last week of class.

**Downstairs Labs**

- Lab 1 Alternating Current
- Lab 2 Three Phase Transformers
- Lab 3 DC Generators
- Lab 4 Induction Motors
- Lab 5 AC Synchronous Generators
- Lab 6 Generator Paralleling  
STCW 7-1E (Parallel generators)

**Upstairs Labs**

- Lab 1 Residential Wiring  
Lock-out / Tag-out Procedures  
Use of Voltmeter, Ammeter, Wiggy, DMM  
STCW 3-1A (Use of Meters)
- Lab 2 Basic Principles of Motor Control: Exercises 1-1 to 1-5  
Homework: Read Chapter 2 in Lab Volt Manual before Lab 3
- Lab 3 Basic Control Circuits Exercises 3-1 and 3-2
- Lab 4 Basic Control Circuits Cont. Exercises 3-3, 3-4, and 3-5
- Lab 5 Jogging Control Circuits. Exercises 4-1, 4-2, and 4-3
- Lab 6 Reduced Voltage Starters. Exercises 5-1 and 5-2

Troubleshooting Simulator satisfies: STCW 3-1B (Troubleshooting)

**IMPORTANT RULES:**

**Safety First!**

**No food or drink in the lab!!**