

**College of Micronesia – FSM**  
**P.O. Box 159**  
**Kolonia, Pohnpei**

**Course Outline Cover Page**

**Electro Technology II**  
 Course Title

**ME 231**  
 Department and Number

**Course Description:** This course will provide the student with the knowledge and skills required to safely operate, maintain, and manage electrical equipment on vessels.

**Prepared by:** Brent Villiers

**State:** FSM-FMI

	Hours per Week	No. Of Weeks	Total Hours	Semester
Credits				
Lecture	3/6/12/24	16/8/4/2	48	3
Laboratory	3/6/12/24	16/8/4/2	48	1
		Total Semester Credits:		4

**Purpose of Course**

Degree Requirement	_____XX_____
Degree Elective	_____
Advanced Certificate	_____
Certificate	_____
Remedial	_____
Other (Workshop)	_____

**Prerequisite Course(s):** ME 224 Electro Technology I

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**Signature, Chairman, Curriculum Committee**

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**Date Approved by Committee**

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**Signature, President, COM-FSM**

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**Date Approved by the President**

**General Objective:** Electrical, electronic and control engineering at the operational level requires the student to safely operate, maintain, and manage electrical equipment on vessels.

**Learning Outcomes:**

On successful completion of this course the student will be able to:

1. Identify the common SI units used in electricity
2. Manage the effects of temperature, conductor size, and electric current on the resistance and power of an electric circuit.
3. Carry out series, parallel and combination battery connections in accordance with safety and operational requirements.
4. Operate and manage electrical equipment utilizing magnetic fields.
5. Operate and maintain AC rotating machinery and associated circuits in accordance with operating manuals, technical specifications and safety requirements.
6. Operate, manage, and monitor basic AC equipment in accordance with established procedure and safety requirements.
7. Operate and maintain, and manage single and three phase electrical distribution systems on vessels in accordance with manufacturer recommendations, technical specifications, safety and statutory requirements.
8. Operate and maintain shipboard DC electrical equipment in accordance with established procedure and safety requirements.

***STUDENTS SHOULD BE MADE AWARE OF OCCUPATIONAL HEALTH AND SAFETY ISSUES IN ALL SITUATIONS AND BE EXPECTED TO DEMONSTRATE SAFE WORKING PRACTICES AT ALL TIMES.***

**Outline of Content:**

This course contains:

**1. Units**

- SI base and derived units
- Multiples and submultiples

**2. Electrical Circuit**

- Ohm's Law
- Resistivity
- Series, parallel and combination circuits
- Voltage, current, and voltage drop.
- Power and energy
- Wheatstone bridge

**3. Cells**

- Ampere hour capacities and efficiencies
- Voltage
- Series and parallel connections

**4. Magnetism**

- Magnetic fields and materials
- Magnetic fields due to a current in straight conductors and coils.
- Fleming's right hand rule
- Effects of iron, flux density, total flux, reluctance and permeability.
- Generation of EMF
- Torque

**5. AC Theory**

- AC. Current and voltage.
- Maximum, average, and RMS values
- Inductance
- Power and power factor

**6. Rotating Machinery**

- Single and three phase induction motors
- Current requirements
- DOL and star/delta starters
- Speed control
- Synchronous alternators
- Operation and maintenance

**7. AC Distribution circuits**

- Single and three phase distribution system
- Operation and maintenance
- Protection devices
- Faults and fault finding
- Parallel operation of alternators
- Transformers

**8. DC Systems and Equipment**

- DC generators, DC motors, and DC starters
- Ward Leonard system
- Operation and maintenance
- Protection devices

**Learning Outcomes:** On completion of this course the learner will be able to:

**Learning Outcome 1** Identify the common SI units used in electricity.

Assessment criteria

- 1.1 SI and basic units are identified.
- 1.2 Multiple of units are converted to and from basic units.

Conditions and Method of assessment	<p>1.3 Quantities measured and their appropriate units are matched.</p> <p>As specified in the Assessment Strategy listed at the end of this outline and by a combination of:</p> <ul style="list-style-type: none"> <li>• Written assessment</li> <li>• Calculations</li> <li>• Assignments</li> <li>• Oral assessment</li> <li>• Practical assessment</li> </ul>
<b>Learning Outcome 2</b>	<b>Manage the effects of temperature, conductor size, and electric current on the resistance and power of an electric circuit.</b>
Assessment criteria	<p>2.1 Resistivity and its relationship with conductor length and cross sectional area are explained and calculated.</p> <p>2.2 The affect on resistance due to the change in temperature is explained.</p> <p>2.3 The current, voltage, voltage drop, and power of series, parallel, and combination circuits are calculated.</p> <p>2.4 Systems on vessels represented by the circuits in 2.3 are identified.</p> <p>2.2 The use of a Wheatstone bridge circuit to determine the value of an unknown resistor is explained.</p>
Conditions and Method of assessment	<p>As specified in the Assessment Strategy listed at the end of this outline and by a combination of:</p> <ul style="list-style-type: none"> <li>• Written assessment</li> <li>• Calculations</li> <li>• Assignments</li> <li>• Oral assessment</li> <li>• Practical assessment</li> </ul>
<b>Learning Outcome 3</b>	<b>Carry out series, parallel and combination battery connections in accordance with safety and operational requirements.</b>
Assessment criteria	<p>3.1 Ampere-hour capacities is described.</p> <p>3.2 Connecting batteries in series, parallel, and combination circuits in accordance with safety and operational requirements is demonstrated.</p> <p>3.3 Power and capacity requirements of battery banks are calculated.</p>

Conditions and Method of assessment	As specified in the Assessment Strategy listed at the end of this outline and by a combination of: <ul style="list-style-type: none"> <li>• Written assessment</li> <li>• Calculations</li> <li>• Assignments</li> <li>• Oral assessment</li> <li>• Practical assessment</li> </ul>
<b>Learning Outcome 4</b>	<b>Operate and manage electrical equipment utilizing magnetic fields.</b>
Assessment criteria	<p>4.1 The form and properties of magnetic fields surrounding a single conductor and multi-turn coils are described.</p> <p>4.2 Flux density, reluctance, and permeability are defined</p> <p>4.3 Fleming's right hand rule is explained.</p> <p>4.4 The generation of EMF by a rotating conductor within a magnetic field is explained.</p> <p>4.5 The creation of a torque on a current carrying coil within a magnetic field is explained.</p> <p>4.6 The affect of electromagnetism on AC machines, including: <ul style="list-style-type: none"> <li>• Motors;</li> <li>• Generators;</li> <li>• Transformers; and</li> <li>• Solenoids</li> </ul> are described, and simple problems solved.</p>
Conditions and Method of assessment	As specified in the Assessment Strategy listed at the end of this outline and by a combination of: <ul style="list-style-type: none"> <li>• Written assessment</li> <li>• Calculations</li> <li>• Assignments</li> <li>• Oral assessment</li> <li>• Practical assessment</li> </ul>
<b>Learning Outcome 5</b>	<b>Operate and maintain AC rotating machinery and associated circuits in accordance with operating manuals, technical specifications and safety requirements.</b>
Assessment criteria	5.1 The construction and operation of single and three phase induction electric motor are described.

	5.2	Starting and operating current requirements of motors in 5.1 are explained.
	5.3	DOL starters and star/delta starters are explained.
	5.4	Speed controls of AC motors are described.
	5.5	The construction and operation of a synchronous alternator are described.
	5.6	The operation and maintenance of AC rotating machinery in accordance with manufacturer recommendations and safety requirements are demonstrated.
Conditions and Method of assessment		As specified in the Assessment Strategy listed at the end of this outline and by a combination of: <ul style="list-style-type: none"> <li>• Written assessment</li> <li>• Calculations</li> <li>• Assignments</li> <li>• Oral assessment</li> <li>• Practical assessment</li> </ul>
<b>Learning Outcome 6</b>		<b>Operate, manage, and monitor basic AC equipment in accordance with established procedure and safety requirements.</b>
Assessment criteria	6.1	The maximum, RMS, and average values of a sinusoidal wave are defined and their application to AC voltage is explained.
	6.2	Current, voltage, power, and power factor of a simple series AC circuit using Ohms Law are calculated.
	6.3	The effect of inductance in an AC circuit is explained.
Conditions and Method of assessment		As specified in the Assessment Strategy listed at the end of this outline and by a combination of: <ul style="list-style-type: none"> <li>• Written assessment</li> <li>• Calculations</li> <li>• Assignments</li> <li>• Oral assessment</li> <li>• Practical assessment</li> </ul>
<b>Learning Outcome 7</b>		<b>Operate and maintain, and manage single and three phase electrical distribution systems on vessels in accordance with manufacturer recommendations, technical specifications, safety and statutory requirements.</b>

Assessment criteria	<p>7.1 Single and three phase marine electrical distribution systems are described and their components and functions explained.</p> <p>7.2 The basic operation and maintenance of manufacturer recommendations, safety and statutory requirements the systems in 7.1 in accordance with are demonstrated.</p> <p>7.3 Common electrical faults, their causes, effects, basic fault finding procedures, and relevant protection devices are described.</p> <p>7.4 Parallel operation and load sharing of AC alternators in accordance with established procedures are demonstrated and their load/voltage curves are described.</p> <p>7.5 The construction, operation, and maintenance of transformers in accordance with safe and good practices are explained.</p>
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Conditions and Method of assessment	<p>As specified in the Assessment Strategy listed at the end of this outline and by a combination of:</p> <ul style="list-style-type: none"> <li>• Written assessment</li> <li>• Calculations</li> <li>• Assignments</li> <li>• Oral assessment</li> <li>• Practical assessment</li> </ul>
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**Learning Outcome 8 Operate and maintain shipboard DC electrical equipment in accordance with established procedure and safety requirements.**

Assessment criteria	<p>8.1 The operation and maintenance of DC:</p> <ul style="list-style-type: none"> <li>• Generators;</li> <li>• Motors;</li> <li>• Starters; and</li> <li>• Protection devices</li> </ul> <p>are explained.</p> <p>8.2 Speed control of DC motors is explained.</p> <p>8.3 The operation and applications of a Ward-Leonard system are explained.</p>
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Conditions and Method of assessment	<p>As specified in the Assessment Strategy listed at the end of this outline and by a combination of:</p> <ul style="list-style-type: none"> <li>• Written assessment</li> <li>• Calculations</li> <li>• Assignments</li> <li>• Oral assessment</li> <li>• Practical assessment</li> </ul>
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Delivery strategy

The course provides for delivery by on and off-the-job training and assessment.

Some areas of content may be common to more than one learning outcome, and therefore integration of training and assessment may be appropriate.

Methods of instruction includes:

1. Classroom lectures with handouts, course notes, overhead transparencies (or equivalent), slide presentations, video material, and whiteboard notes;
2. Calculation via examples and tutorials; and
3. Practical demonstrations.

Resource requirements

Delivery of the training will require:

- Classroom
- Whiteboard
- Overhead projector (or equivalent)
- Access to appropriate vessels or models.

Assessment Strategy

## Assessment Method

Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments.

Skill based criteria will be satisfied through practical exercises.

## Condition of Assessment

This course may be assessed on and off the job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels.

Evaluation:

Final Grade for this course will be based on meeting the course requirements at the following percentage rates:

96% - 100%	A – Superior
90% - 95%	B – Above Average
80% - 89%	C – Average
69% - 79%	D – Below Average
0 % - 69%	F – Failure

Attendance:

The COM-FSM attendance policy will apply.