

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

**Course Outline Cover Page**

**Engineering Knowledge - General**  
Course Title

**ME 226**  
Department and Number

**Course Description:** This course provides the student with the knowledge and skills required to safely operate and maintain the auxiliary equipment on a vessel not exceeding 750 kW propulsion power.

**Prepared by:** Brent Villiers

**State:** FSM-FMI

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	4/8/16/32	16/8/4/2	32	2
Laboratory	6/12/24	16/8/4	96	2
Total Semester Credits:				4

**Purpose of Course**

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

**Prerequisite Course(s):** ME 180 Engineering Knowledge II

\_\_\_\_\_  
Signature, Chairman, Curriculum Committee

\_\_\_\_\_  
Date Approved by Committee

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Signature, President, COM-FSM

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Date Approved by the President

**General Objective:** By successfully completing this course, students will have been provided with the skills required to safely operate and maintain the auxiliary equipment on a vessel not exceeding 750 kW propulsion power.

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

1. Operate and maintain the bilge, ballast, fire main, and domestic water pumping systems in accordance with normal and emergency procedures, environmental concerns, and statutory requirements.
2. Operate and maintain hydraulic and steering systems on vessels in accordance with manufacturer recommendations and statutory requirements.
3. Operate and maintain the vessel's deck machinery in accordance with safe and established procedures.
4. Operate and maintain the shafting system and related components in accordance with manufacturer recommendations and statutory requirements.
5. Operate and manage the refrigeration plant on vessels in accordance with operating manuals, safety and statutory requirements, and environmental concerns.
6. Identify fire related hazardous on vessels and operate and maintain the fire detection, prevention, and extinguisher plant in accordance with established emergency procedure.
7. Operate and interpret machinery space instruments and gauges in accordance with technical specifications and operating manuals.
8. Operate and manage the pollution control equipment on vessels in accordance with operating manuals and legislative requirements.
9. Manage the engineering duties on board a vessel during maintenance and docking operations in accordance with safe and established procedures.

***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. Pumps and Pumping Systems
  - Statutory regulations
  - Fire main, bilge, ballast pumping systems
  - Centrifugal and displacement pumps
  - Valves and piping systems
  - Back flooding and down flooding
  - Emergency pumping arrangements
  - Portable pumps
  - Domestic water systems
  - Fresh water production
  - Operation and maintenance
  
2. Hydraulic and Steering Systems
  - Hydraulic power unit
  - Hydraulic steering systems
  - Feedback and autopilot
  - Emergency steering
  - Operation, maintenance, and fault finding
  
3. Deck Machinery
  - Survey requirements
  - Windlass, capstan/warping winch, anchor, deck/cargo, and ramp winches.
  - Operation, maintenance, fault finding and safety
  
4. Propulsion and Shafting
  - Stern tube
  - Thrust and shaft bearings
  - Fixed and controllable pitch propellers
  - Coupling
  - Removal and fitting
  - Shafting alignment
  - Operation, inspections, and maintenance
  
5. Refrigeration
  - Environmental regulations
  - Cycle of operation
  - Components
  - Hazards with refrigerant gases
  - Faults and operational effects

- Monitoring
- Operation and maintenance
- 6. Fire Detection and Prevention
  - Statutory requirements
  - Hazards
  - Fire categories/classes
  - Fire extinguishers, portable and non portable
  - Detection and alarms
  - Closures
  - Plant operational procedures
  - Hazards of gas systems
- 7. Instruments and Gauges
  - Construction
  - Interpretation of readings
  - Logbooks
- 8. Pollution control
  - Effects of pollution
  - Methods of control
  - MARPOL regulations
  - Emergency procedures
- 9. Slipping, Survey, and Maintenance
  - Statutory requirements
  - Methods
  - Preparation and inspection
  - Maintenance methods schedule
  - Safety
  - Re-floating

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

**Learning Outcome 1** **Operate and maintain the bilge, ballast, fire main, and domestic water pumping systems in accordance with normal and emergency procedures, environmental concerns, and statutory requirements.**

**Assessment criteria**

1.1 The operation and maintenance of a typical pumping system, incorporating ballast, bilge, and fire main duties, in accordance with manufacturer recommendations, statutory requirements, and environmental concerns are demonstrated.

1.2 The components of the system in 1.1, including:

- Pumps;
- Manifolds;

- Isolating, non return, relief and control valves; and
  - Strainers and gratings
- are identified and their functions explained.
- 1.3 The causes and prevention of “back flooding” and “down flooding” in accordance with statutory requirements are explained.
  - 1.4 Emergency pumping procedures, including the use of portable pumps, in accordance with statutory requirements are demonstrated.
  - 1.5 Domestic water systems (sanitary and fresh water) are described.
  - 1.6 Methods of producing fresh water from seawater in accordance with established operating procedures 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:

- Written assessment
- Calculations
- Assignments
- Oral assessment
- Practical assessment

**Learning Outcome 2**

**Operate and maintain hydraulic and steering systems on vessels in accordance with manufacturer recommendations and statutory requirements.**

Assessment criteria

- 2.1 The operation of a typical hydraulic power unit and related components are described, and their survey requirements identified.
- 2.2 The statutory requirements of normal and emergency steering systems are identified.
- 2.3 The layout and components of a hydraulic steering system is explained.
- 2.4 The operation, faultfinding, and maintenance of a hydraulic steering system in accordance with manufacturer recommendations and statutory requirements are demonstrated.
- 2.5 The operation of a split steering system (telemotor), including charging and purging, in accordance with statutory requirements is described.
- 2.6 The operation of autopilot and feedback components is explained.

- 2.7 The operation of emergency steering gear, including communication, in accordance with statutory requirements is demonstrated.

Conditions and  
Method of assessment

As specified in the Assessment Strategy listed at the end of this outline and by a combination of:

- Written assessment
- Calculations
- Assignments
- Oral assessment
- Practical assessment

### Learning Outcome 3

**Operate and maintain the vessel's deck machinery in accordance with safe and established procedures.**

Assessment criteria

- 3.1 The survey requirements for deck machinery are identified.
- 3.2 The safe operation and associated dangers with windlasses, capstans, and warping winches are described.
- 3.3 Protective devices fitted to anchor and deck winches, and ramps in accordance with safety and statutory requirements are explained.
- 3.4 Common mechanical faults and the basic maintenance required to ensure the operation of deck machinery in accordance with manufacturer recommendations; safety and statutory 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:

- Written assessment
- Calculations
- Assignments
- Oral assessment
- Practical assessment

<b>Learning Outcome 4</b>	<b>Operate and maintain the shafting system and related components in accordance with manufacturer recommendations and statutory requirements.</b>
Assessment criteria	<p>4.1 A typical shafting system and its components, including: shaft couplings, thrust bearings, shaft bearings, and stern tubes are described.</p> <p>4.2 Oil and water lubricated stern tubes are described and relevant statutory regulations identified.</p> <p>4.3 Propulsion thrust arrangements are described.</p> <p>4.4 Fixed and controllable pitch propeller action, including;</p> <ul style="list-style-type: none"> <li>• Pitch;</li> <li>• Pitch angle;</li> <li>• Diameter;</li> <li>• Cavitations; and</li> <li>• Excitation</li> </ul> <p>are explained.</p> <p>4.5 Shaft couplings, propeller attachment (including; tapers, keys, keyways, and locking devices), and their fitting and removal procedures in accordance with manufacturers recommendations are explained.</p> <p>4.6 Shaft alignment, including the propeller and intermediate shafts, in accordance with established practices is described.</p> <p>4.7 Inspection, measurement, lubrication, and maintenance of propulsion and transmission equipment in accordance with technical specifications, manufacturer recommendations, and statutory requirements are described.</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 5</b>	<b>Operate and manage the refrigeration plant on vessels in accordance with operating manuals, safety and statutory requirements, and environmental concerns.</b>
Assessment criteria	<p>5.1 Refrigeration gases and the effects on the environment are explained.</p> <p>5.2 A typical refrigeration system with appropriate instrumentation is described, and its operation explained.</p> <p>5.3 Safety devices, including; gauges, high and low pressure cut outs, relief valves, low oil alarms/cut outs, and liquid sight glasses in accordance with safety and statutory requirements are identified.</p> <p>5.4 The operational risks associated with: R717, R12, R22, R502, and R134(a) are explained.</p> <p>5.5 The operations of secondary systems, including brine systems, are explained.</p> <p>5.6 Common faults and their effects on the operation of the plant, including: air and moisture in the system, loss of liquid/gas, leakage, condenser cooling faults, and evaporator faults in accordance with technical specifications and operating manuals are identified.</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 6</b>	<b>Identify fire related hazardous on vessels, and operate and maintain the fire detection, prevention, and extinguisher plant in accordance with established emergency procedure.</b>
Assessment criteria	<p>6.1 Classes/categories of fires and operational fire hazards of vessels are identified.</p> <p>6.2 The causes of LPG related fires/explosions and its prevention are explained.</p> <p>6.3 Portable and non-portable systems, together with appropriate extinguishment mediums</p>



	for different situations in accordance with established procedures are explained.
6.4	The basic operation and maintenance of fire detection and extinguisher systems, including: <ul style="list-style-type: none"> <li>• fire detection and alarms;</li> <li>• closing appliances;</li> <li>• remote shut-off;</li> <li>• gas/foam/water mist; and</li> <li>• flooding systems</li> </ul> in accordance with statutory requirements and manufacturer recommendations are demonstrated.
6.5	Procedures used to control/extinguish large compartment fires in accordance with established emergency procedure are described.
6.6	Risks associated with gas flooding systems are explained
6.7	The consequences of flooding the machinery space due to fire fighting are described.
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 interpret machinery space instruments and gauges in accordance with technical specifications and operating manuals.</b>
Assessment criteria	7.1 The operation of: <ul style="list-style-type: none"> <li>• Pressure gauges;</li> <li>• Manometers;</li> <li>• Thermometers/pyrometers;</li> <li>• Flow meters;</li> <li>• Level gauges;</li> <li>• Pneumercator gauges; and</li> <li>• Oxygen/gas meters are described.</li> </ul> 7.2 Information from the above instrumentation is correctly interpreted.
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> </ul>

- Calculations
- Assignments
- Oral assessment
- Practical assessment

**Learning Outcome 8****Operate and manage the pollution control equipment on vessels in accordance with operating manuals and legislative requirements.**

## Assessment criteria

- 8.1 The causes of pollution, especially due to machinery space discharges, are identified.
- 8.2 The effects of pollution on the environment are described.
- 8.3 The operation and maintenance of pollution prevention systems, including: oily water separators; sludge/sewerage systems; holding tanks; and fueling processes in accordance with operating manuals and legislative requirements are demonstrated.
- 8.4 The relevant MARPOL regulations are identified.
- 8.5 Procedures when dealing with oil spills in accordance with environmental concerns and statutory requirements are described.

## Conditions and Method of assessment

As specified in the Assessment Strategy listed at the end of this outline and by a combination of:

- Written assessment
- Calculations
- Assignments
- Oral assessment
- Practical assessment

**Learning Outcome 9****Manage the engineering duties on board a vessel during maintenance and docking operations in accordance with safe and established procedures.**

## Assessment criteria

- 9.1 The requirement for commercial vessels to undergo periodic maintenance and survey are identified.
- 9.2 Methods of slipping and dry docking in accordance with established procedure are explained
- 9.3 Preparations and inspections involved with slipping/docking operations in accordance to established procedures, safety and statutory requirements are demonstrated.
- 9.4 Corrosion, sacrificial anodes, and impressed current systems are described.

Conditions and Method of assessment	<p>9.5 Preparation of work and survey schedules in accordance with established procedure, operational and safety requirements are demonstrated.</p> <p>9.6 Measurements and inspections in accordance with technical specifications, manufacturer recommendations, and statutory requirements are described</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>
<u>Delivery strategy</u>	<p>The module provides for delivery by on and off-the-job training and assessment.</p> <p>Some areas of content may be common to more than one learning outcome, and therefore integration of training and assessment may be appropriate.</p> <p>Methods of instruction includes:</p> <ol style="list-style-type: none"> <li>1. Classroom lectures with handouts, course notes, overhead transparencies (or equivalent), slide presentations, video material, and whiteboard notes;</li> <li>2. Tutorials;</li> <li>3. Practical demonstrations;</li> <li>4. Practical exercises; and</li> <li>5. Laboratory work.</li> </ol>
<u>Resource requirements</u>	<p>Delivery of the training will require:</p> <ul style="list-style-type: none"> <li>• Classroom</li> <li>• Whiteboard</li> <li>• Overhead projector (or equivalent)</li> <li>• Video player</li> <li>• Access to appropriate vessels or models.</li> <li>• Appropriate models</li> <li>• Appropriate testing equipment</li> <li>• Appropriate tools and safety equipment</li> </ul>

**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 module 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.