

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

**Course Outline Cover Page**

**Engineering Knowledge - Motor**  
 Course Title

**ME 227**  
 Department and Number

**Course Description:** To provide the learner with the knowledge and skills to safely operate and maintain a propulsion plant and other related equipment and systems 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

\_\_\_\_\_  
 Signature, President, COM-FSM

\_\_\_\_\_  
 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 a propulsion plant and other related equipment and systems 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 a marine diesel engines not exceeding 750kW, in accordance with manufacturer recommendations, technical specifications, and safety requirements
2. Operate and maintain the fuel supply and fuel injection system in accordance with manufacturer recommendations, technical specifications and safety requirements.
3. Ensure proper handling and storage of fuel in accordance to established procedures, safe and statutory requirements.
4. Manage the operation and maintenance of a diesel engine lubricating oil system in accordance to established procedures and technical specifications.
5. Operate and maintain the marine diesel engine cooling system in accordance with technical specifications.
6. Start up, shut down, monitor the operation, and recognize common faults of marine diesel engines in accordance to technical specifications, manufacturer recommendations, safety and statutory requirements.
7. Operate and maintain the reverse/reduction gears and transmission devices in accordance manufacturer recommendations and safety requirements.
8. Operate and maintain the starting air supply system to a marine diesel engine in accordance with manufacturer recommendation, safety and statutory 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. Marine Diesel Engines
  - Two and four stroke engines
  - Component and functions
  - Cam and valve timing
  - Turbocharger and intercoolers
  - Operational and maintenance
2. Fuel Systems
  - Fuel systems layout
  - Fuel pump and injector
  - Combustion
  - Faults and settings
  - Emission
  - Governors and operational settings
  - Operation and maintenance
3. Fuel Oils and Handling
  - Survey requirements
  - Storage and handling
  - System safety devices
  - Contamination
  - Filters and purifies
  - Tank entry
  - Flash point
4. Lubricating Oil System
  - Requirements
  - Properties and additives
  - Contamination
  - System components
  - Operation and maintenance schedule
  - Condition monitoring and system faults
  - Alarms and safety devices
5. Cooling Systems
  - Heat exchanger and keel cooling
  - Cooling system and components
  - Electrolysis/corrosion effects and prevention
  - Operation and maintenance
  - Testing and monitoring

## 6. Diesel Engine Operation

- Methods of starting
- Alarm, interlock, shut down, safety devices
- Starting, shutdown and operational procedures
- Faults, and remedial actions
- Logbook
- Maintenance schedule
- Safety precautions

## 7. Transmission

- Reduction and reversal gearing
- Flexible couplings
- Thrust bearings
- Clutches
- Statutory regulations
- Methods of propulsion reversal

## 8. Compressed air system

- Air compressor
- Pressure vessels
- Safety devices
- Operation and maintenance

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

**Learning Outcome 1** **Operate and maintain a marine diesel engines not exceeding 750kW, in accordance with manufacturer recommendations, technical specifications, and safety requirements**

Assessment criteria

- 1.1 Common terminology related to internal combustion engines including power, torque, scavenging, efficiency, turbulence and compression ratio is described.
- 1.2 Operating cycle and components of 2 and 4 stroke marine diesel engines, including the basic timing diagrams, are described.
- 1.3 Various combustion chamber designs and configurations are identified.
- 1.4 Valve overlap, valve rotators, cam lift, valve clearances, and timing in accordance to technical specifications are explained.
- 1.5 Turbocharger components, operation, and monitoring procedures in accordance to technical specifications are explained.

- 1.6 Operation, maintenance, and monitoring of charge air coolers in accordance to manufacturer recommendations are demonstrated.
- 1.7 Methods of obtaining the required calibration of a diesel engine, including crankshaft deflections, bearing clearances, piston, rings and linear clearances, in accordance with technical specifications 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 the fuel supply and fuel injection system in accordance with manufacturer recommendations, technical specifications and safety requirements.**

Assessment criteria

- 2.1 The layout of a typical marine fuel system, from the double bottom tanks to the injector, is explained.
- 2.2 The operation and maintenance of charge/transfer pumps including, gear, diaphragm, and plunger types, are explained.
- 2.3 Basic operation, maintenance, and control of fuel injection pumps including single unit, in line, rotary, pressure, and helix profile are explained.
- 2.4 Operation and maintenance of fuel injectors are in accordance to manufacturer recommendations are demonstrated.
- 2.5 Common defects, setting of an injector in accordance to technical specifications, and their effect on engine performance, including exhaust emission, are explained.
- 2.6 Basic speed control of a marine diesel engine through mechanical, hydraulic, pneumatic, and electronic/hydraulic governing is 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 3</b>	<b>Carry out the handling and storage of fuel in accordance with established procedures and safety/statutory requirements.</b>
Assessment criteria	<p>3.1 Survey requirements for fuel storage tanks and pipe systems are explained.</p> <p>3.2 Typical fuel storage and handling arrangements, including their components, are identified.</p> <p>3.3 Procedures for safe handling of fuel, including filling, venting, transferring and draining, in accordance with safe and statutory requirements are demonstrated.</p> <p>3.4 Operations of the various safety devices, such as shut down devices are described.</p> <p>3.5 Causes of fuel contamination and measures to avoid contamination are described.</p> <p>3.6 Operation and maintenance of purifiers and filters in accordance with manufacturer recommendations are demonstrated.</p> <p>3.7 The requirements and procedures for “Gas Free” situations are identified.</p> <p>3.8 “Flash Point” and its relevance to fuel handling and storage are explained.</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>Manage the operation and maintenance of a diesel engine lubricating oil system in accordance with established procedures and technical specifications.</b>
Assessment criteria	<p>4.1 Purpose and requirements of lubricating oils are explained.</p> <p>4.2 Properties of lubrication oils and additives used are explained.</p> <p>4.3 Lubricating oil contamination and remedial actions in accordance with established practices are described.</p> <p>4.4 Lubrication oil sampling and the relevance to engine condition monitoring in accordance with technical specifications are explained.</p> <p>4.5 Functions and maintenance of components in an engine lubrication system, including pumps, relief and regulating valves, full flow and bypass filters, magnetic filters, heat exchangers, coalesces, and purifiers, are described.</p> <p>4.6 Production of a lubrication maintenance schedule based on the engine manufacturer's recommendation is described.</p> <p>4.7 Lubricating system faults, alarms, and safety devices are identified and actions in accordance with established procedure are demonstrated.</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 maintain the marine diesel engine cooling system in accordance with technical specifications.</b>
Assessment criteria	<p>5.1 Methods of cooling are described.</p> <p>5.2 Heat exchangers, cooling water systems, cooling water flow arrangements, and thermostatic controls are described.</p> <p>5.3 Causes, effects, and prevention of corrosion/electrolysis in cooling water</p>

	systems, including established water testing procedures are identified.
	5.4 Causes of cooling system failure, their consequences, and actions in accordance with manufacturer recommendations are described.
	5.5 Maintenance required for system operation in accordance with technical specifications is explained.
	5.6 Operation of temperature and pressure alarms, and shutdown devices 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 6</b>	<b>Start up, shut down, monitors the operation, and recognizes common faults of marine diesel engines in accordance with technical specifications, manufacturer recommendations, and safety/statutory requirements.</b>
Assessment criteria	6.1 Starting methods for diesel engines, including mechanical, hydraulic and pneumatic systems, are explained.
	6.2 Alarms, interlocks, and shutdown devices in accordance to safety and statutory requirements are described.
	6.3 Preparation, starting, shutdown, and running procedures of a marine diesel engine and related systems in accordance to manufacturer recommendations safety requirements are demonstrated.
	6.4 Fault and failure conditions including: <ul style="list-style-type: none"> <li>• Failure to start;</li> <li>• Low operating power;</li> <li>• Bad exhaust emission;</li> <li>• Loss of lube oil pressure;</li> <li>• High lube oil temperature;</li> <li>• Overheating of engines/components;</li> <li>• Vibration;</li> <li>• Fluctuation of engine revs; and</li> </ul>



	<ul style="list-style-type: none"> <li>• Crankcase explosions are identified, and appropriate actions to prevent and rectify the conditions are described.</li> </ul>
	6.5 Role of an engine room logbook in troubleshooting, trend analysis, and maintenance of a diesel engine in accordance with established practices is described.
	6.6 The use of an appropriate maintenance schedule is demonstrated.
	6.7 Safety precautions during maintenance, testing and fault finding in accordance to safe working practices 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 7</b>	<b>Operate and maintain the reverse/reduction gears and transmission devices in accordance with manufacturer recommendations and safety requirements.</b>
Assessment criteria	7.1 Relevant statutory regulations dealing with propulsion systems and equipment are explained.
	7.2 Transmission systems, including flexible couplings, thrust bearings, and reduction gear arrangements, are described.
	7.3 Propulsion reversal methods, including clutches and reversing gear, 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 8</b>	<b>Operate and maintain the starting air supply system to a marine diesel engine in accordance with manufacturer recommendation, safety and statutory requirements.</b>
Assessment criteria	<p>8.1 Operation and maintenance of air compressors, including the effects of clearance, efficiency, and filters, in accordance with manufacturer recommendations and safety requirements are demonstrated.</p> <p>8.2 Hazards associated with starting air systems are identified.</p> <p>8.3 Safety devices, including pressure relief valves, bursting discs, fusible plugs and automatic drain valves, in accordance with safety and statutory requirements are explained.</p> <p>8.4 Construction, operation, and maintenance of compressed air pressure vessels are 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>
<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>

Resource requirements

Delivery of the training will require:

- Classroom
- Whiteboard
- Overhead projector (or equivalent)
- Video player
- Access to appropriate vessels or models.
- Appropriate models
- Appropriate testing equipment
- Appropriate tools and safety equipment

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