

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

Course Outline Cover Page

Engineering Knowledge I
Course Title

MME 161
Department and Number

Course Description: To provide the student with the knowledge and skills to safely operate a propulsion plant and other auxiliary equipment on a vessel not exceeding 250 kW propulsion power.

Prepared by: Brent Villiers

State: FSM-FMI

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	2/4/8/16	8/4/2/1	16	1
Laboratory	12/24	12/6	144	3
Total Semester Credits:				4

Purpose of Course

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

Prerequisite Course(s): Safety Certificate

Signature, Chairman, Curriculum Committee

Date Approved by Committee

Signature, President, COM-FSM

Date Approved by the President

General Objective: In addition to meeting COM-FSM's Certificate of Achievement criteria, this course is targeted at students and mariners who wish to obtain a Certificate of Competency as Master Grade 6 in accordance with the South Pacific Maritime Code. This course covers part of the syllabus requirements as described in the code and on successful completion of this course the student or mariner will be able to safely operate a propulsion plant and other auxiliary equipment on a vessel not exceeding 250 kW propulsion power.

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

1. Describe the operating principles of marine diesel engines not exceeding 250kW, recognise major components and describe their function.
2. Start up, shut down and monitor the operation of marine diesel engines and recognise common defects.
3. Operate marine outboard engines, recognise common defects and carry out user maintenance
4. Operate and maintain a reverse/reduction gearbox and shafting.
5. Operate and maintain the vessel's hydraulic systems and steering gear.
6. Operate the bilge pumping and deck wash systems, recognise faults, and carry out regular maintenance.
7. Manage a low voltage DC battery system in accordance with safe electrical practice.
8. Operate and manage an AC generator, AC distribution system, and shore power connection in accordance with safe electrical practices.
9. Operate and maintain the fire fighting and safety equipment and conduct on board inspection to maintain their survey requirements.
10. Manage the engineering duties on board a vessel during docking operations.
11. Start up and shut down a small refrigeration plant, explain the basic operating principles and recognise basic operating faults.
12. Operate deck machinery in a safe manner and carry out regular user maintenance
13. Calculate the consumption of fuel and lubricating oil for a particular voyage

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
 - 2 and 4 stroke diesel engines
 - Major diesel engines components and functions
 - Basic fuel injection systems
 - Turbo chargers
 - Basic lubrication and cooling systems
2. Marine Diesel Engines Operation
 - Methods of starting and preparation
 - Indicator readings, faults, and remedial action
 - Refueling and fuel spills
 - Basic operation and maintenance
3. Outboard Engine Operation
 - Components and functions
 - Operating checks and maintenance
 - Routine user servicing
4. Gearboxes and Shafting
 - Basic operation and maintenance
 - Introduction to propulsion reversal
 - Common faults
 - Propeller types and attachment
5. Fire Fighting and Safety Equipment
 - Portable fire extinguishers
 - Fixed fire fighting system
 - Alarms and actions
 - Precautions with petrol fumes and LPG leaks
 - LPG alarms and actions
 - Emergency bilge pumping
 - Precautions before burning and welding work
 - Checks to meet survey requirements
6. Pumping Systems
 - Bilge pumping system
 - Back flooding
 - Basic operation and common faults
 - Basic user maintenance
7. DC Battery Systems
 - Testing battery condition
 - Parallel and series connections
 - Safety precautions with batteries
 - Introduction to fuses and circuit breakers

8. AC Electrical and Distribution Systems
 - Introduction to generator operation
 - Safety precautions
 - Basic AC distribution system
9. Hydraulic Systems and Steering Gears
 - Mechanical and hydraulic steering systems
 - Basic operation principles
 - Pre-departure checks and common faults
 - Basic maintenance and precautions
10. Slipping and Survey
 - Periodic survey and maintenance
 - Basic preparation and inspections
 - Sacrificial anodes
 - Stern tube and rudder
11. Refrigeration
 - Environment regulations
 - Basic mechanical refrigeration plant
 - Components
 - Basic operation and maintenance
 - Introduction to refrigerants
12. Deck Machinery & Maintenance
 - Operation of deck machinery
 - Dangers and safety
 - Basic routine maintenance
13. Fuel and Lubricating Oil Consumption
 - Speed
 - Distance
 - Time
 - Rates of Fuel and Lubricating Oil consumption
 - Consumption, reserve, and fuel order

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

Learning Outcome 1 **Manage a marine diesel engine not exceeding 250 kW, in accordance with manufacturer recommendations, technical specifications, and safety requirements.**

Assessment criteria

- 1.1 Operating cycles of 2 and 4 stroke marine engines is described.
- 1.2 The function of basic diesel engine components such as the piston, connecting rod and valves are described.
- 1.3 The lubrication system and its basic components are described.

	1.4	The fuel system and its basic components are described.
	1.5	The turbocharger is identified and its function explained.
	1.6	The operation of simple seawater cooling system and its components 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"> • Written assessment • Calculations • Assignments • Oral assessment • Practical assessment
Learning Outcome 2		Start up, shut down and monitor the operation of marine diesel engines in accordance to established procedure and recognize common defects.
Assessment criteria	2.1	The basic checks and procedures to be followed before starting an engine are explained.
	2.2	The checks to be made if an engine fails to start are explained.
	2.3	Engine gauge readings are interpreted.
	2.4	Warm up and cool down requirements are explained.
	2.5	Indication of engine overheating and appropriate actions are explained.
	2.6	Actions to be taken on identifying low Lube oil pressure are 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"> • Written assessment • Calculations • Assignments • Oral assessment • Practical assessment

Learning Outcome 3	Operate marine outboard engines, recognize common defects and carry out user maintenance in accordance with manufacturer recommendations, technical specifications, and safety requirements.
Assessment criteria	<p>3.1 The basic construction of a marine outboard engine is explained</p> <p>3.2 Checks and procedures before starting an outboard is described</p> <p>3.3 Checks to be made if an engine fails to start are described.</p> <p>3.4 Warm up requirements are explained.</p> <p>3.5 Engine overheating and appropriate actions are explained.</p> <p>3.6 Routine user servicing is 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"> • Written assessment • Calculations • Assignments • Oral assessment • Practical assessment
Learning Outcome 4	Operate and maintain a reverse/reduction gearbox and shafting systems in accordance with manufacturer recommendations and safety requirements.
Assessment criteria	<p>4.1 Reduction ratio is explained.</p> <p>4.2 Correct procedure of changing from ahead to astern is explained.</p> <p>4.3 Checks of the gearbox and drive train before sailing are described.</p> <p>4.4 Common operating faults that of a gearbox and drive train in service are identified.</p> <p>4.5 Basic maintenance of the drive train such as leaking stern glands, worn shaft bearings, and faulty couplings are identified and the remedial action 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"> • Written assessment

- Calculations
- Assignments
- Oral assessment
- Practical assessment

Learning Outcome 5 Operate and maintain hydraulic and steering systems on vessels in accordance with manufacturer recommendations and statutory requirements.

Assessment criteria	<p>5.1 The basic components of steering systems and the steering checks prior to sailing are explained</p> <p>5.2 Emergency steering systems and their correct operations are explained.</p> <p>5.3 Common faults and remedial actions are described.</p> <p>5.4 Safety precautions with hydraulic systems are described.</p> <p>5.5 Basic operational checks and maintenance on a steering system are described.</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"> • Written assessment • Calculations • Assignments • Oral assessment • Practical assessment
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Learning Outcome 6 Operate the bilge pumping and deck wash systems, recognize faults, and carry out regular maintenance in accordance with normal and emergency procedures, environmental concerns, and statutory requirements.

Assessment criteria	<p>6.1 Components of a bilge pumping system are identified and their functions explained.</p> <p>6.2 Operation of an emergency bilge pump is described.</p> <p>6.3 The causes of “backflooding” and methods of prevention are explained.</p> <p>6.4 The corrective action to be taken if the bilge system is not working is described</p>
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- 6.5 Correct use of the general service pump for bilge and fire main duties is described
- 6.6 Basic user maintenance of the system 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:

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

Learning Outcome 7

Manage a low voltage DC battery system in accordance with safe and statutory requirements.

Assessment criteria

- 7.1 The condition of a battery using a hydrometer is assessed.
- 7.2 The connection of batteries in series and parallel are demonstrated and the current and voltage calculated.
- 7.3 The safety precautions associated with the management of batteries are described.
- 7.4 The normal charging procedure for a battery is explained.
- 7.5 The purpose of fuses and circuit breakers in electrical circuits and the dangers of replacing blown fuses with those of the incorrect rating is described.
- 7.6 “Short circuit”, its occurrence, and associated dangers are explained

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 8 **Operate and manage an AC generator, AC distribution system, and shore power connection in accordance with safe and statutory electrical practices.**

Assessment criteria	<p>8.1 The start up procedure of a generator and checks for correct operation are described.</p> <p>8.2 Overloading of the generator and the correct operator actions are identified.</p> <p>8.3 Safety precautions when working with AC power supplies, possible causes of fatal electrical shock, and actions to be taken are identified.</p> <p>8.4 Basic single-phase AC power supply distribution and color-coding of insulated wires are described.</p> <p>8.5 Precautions and checks to be made before connecting the vessel to shore power are described.</p> <p>8.6 Safety precautions to take when shore power is connected to the vessel on a slipway are described.</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"> • Written assessment • Calculations • Assignments • Oral assessment • Practical assessment
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Learning Outcome 9 **Operate and maintain the fire fighting and safety equipment and conduct on board inspection to maintain their survey requirements in accordance with established emergency procedure.**

Assessment criteria	<p>9.1 Response to a machinery space fire alarm is described.</p> <p>9.2 Inspection of fixed fire system in a small vessel's machinery space and survey requirements are described.</p> <p>9.3 The safety precautions to be taken with petrol fumes and LPG leaks are explained</p> <p>9.4 The actions to taken in case of an alarm indicating a LPG leak are explained.</p>
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- 9.5 The purpose of an emergency fire pump its testing are described.
- 9.6 Precautions to be taken before burning and welding work is carried out on board are explained.

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 10

Manage the engineering duties on board a vessel during docking operations in accordance with safe and established procedures.

Assessment criteria

- 10.1 The requirement for periodic maintenance and survey are described.
- 10.2 Preparations and inspections involved with slipping operations are described.
- 10.3 The function of sacrificial anodes and their locations are described.
- 10.4 Measurement of stern tube wear and its consequences are described.
- 10.5 The procedure of opening shipside valves for survey and the maintenance is described.
- 10.6 Checking of rudderstock and pintle bearing wear 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:

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

Learning Outcome 11 **Start up, shut down, and monitor a small refrigeration plant, and recognize basic operating faults in accordance with operating manuals, safety and statutory requirements, and environmental concerns.**

Assessment criteria

11.1 The basic components of a refrigeration plant are identified.

11.2 Reasons for a refrigeration plant cutting out and require re-setting are described.

11.3 Reasons for a refrigeration plant not reaching the required low temperature is described.

11.4 Safety and environmental precautions necessary with refrigerant gases are described.

11.5 Basic checks, start up, monitoring, and shut down of a refrigeration plant 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 12 **Operate and maintain the vessel's deck machinery in accordance with safe and established procedures.**

Assessment criteria

12.1 The safe operation of anchor windlasses and a cargo winches are described.

12.2 The dangers associated with the operation of deck machinery are described.

12.3 Basic maintenance of deck machinery is described.

12.4 The temporary repair of a leaking cooling water pipe is explained.

12.5 The replacement of a leaking pipe flange joint 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:

- Written assessment
- Calculations

- Assignments
- Oral assessment
- Practical assessment

Learning Outcome 13

Determine the consumption of fuel and lubricating oil for a voyage in accordance with established procedure and safe practices.

Assessment criteria

- 13.1 The Rates of Fuel and Lubricating Oil Consumption of the vessel are defined, and their limitations explained.
- 13.2 The consumption of fuel and lubricating oil quantities in liters is calculated.
- 13.3 Fuel and lubricating oil orders are calculated considering appropriate reserves and fuel on board.
- 13.4 Steaming time and range based on fuel and lubricating oil on board are calculated.
- 13.5 Effects of vessel speed and power on the Rate of Fuel Consumption and the fuel requirement are explained.

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

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. Tutorials;
3. Practical demonstrations;
4. Practical exercises; and
5. Laboratory work.

Resource requirements

Delivery of the training will require:

- Classroom
- Whiteboard
- Overhead projector (or equivalent)
- Video player
- Access to an approved diesel powered vessel
- Appropriate models
- Appropriate testing equipment
- Appropriate tools and safety equipment

Assessment Strategy

Assessment Method

Knowledge based criteria will be satisfied through a combination of 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 the individual meeting the course requirements at the following percentage rates:

90% - 100%	A – Superior
80% - 89%	B – Above Average
70% - 79%	C – Average
60% - 69%	D – Below Average
0 - 59%	F – Failure

Attendance: The COM-FSM attendance policy will apply.

Academic Honesty Policy: The College academic honesty policy shall be applied.