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

Course Outline Cover Page

Engineering Knowledge II — Course Title
MME 180 — Department and Number

Course Description: To provide the learner with the knowledge and skills to safely operate and maintain the propulsion plant and auxiliary equipment on a vessel not exceeding 500 kW propulsion power.

Prepared by: Brent Villiers **State:** FSM-FMI

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	8/16/32	8/4/2	64	4
Laboratory	6/12/24	8/4/2	48	1
		Total Semester Credits:		5

Purpose of Course

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

Prerequisite Course(s): Nil

_____ _____
Signature, Chairman, Curriculum Committee **Date Approved by Committee**

_____ _____
Signature, President, COM-FSM **Date Approved by the President**

General Objective: This course has been designed for mariners involved in the operation and maintenance of marine machinery, who wish to attain competence in the operation of machinery of small vessels. The course forms part of the South Pacific Commission, Engineer Class 5 Certificate.

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

1. Manage a marine diesel engine not exceeding 500 kW, in accordance with manufacturer recommendations, technical specifications, and safety requirements.
2. Start up, shut down, and monitor the operation of marine diesel engines in accordance to established procedure and recognize common defects.
3. Operate marine outboard engines, recognize common defects and carry out user maintenance in accordance with manufacturer recommendations, technical specifications, and safety requirements.
4. Operate and maintain a reverse/reduction gearbox and shafting systems in accordance with manufacturer recommendations and safety requirements.
5. Operate and maintain hydraulic and steering systems on vessels in accordance with manufacturer recommendations and statutory requirements.
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.
7. Manage a low voltage DC battery system in accordance with safe and statutory requirements.
8. Operate and manage an AC generator, AC distribution system, and shore power connection in accordance with safe and statutory electrical practices.
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.

10. Manage the engineering duties on board a vessel during docking operations, and maintain the stability and vessel integrity in accordance with safe and established procedures.
11. Describe the terms used in ship construction and basic stability.
12. Operate and maintain the vessel's deck machinery in accordance with safe and established procedures.
13. 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.

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
   - Diesel engines components and functions
   - Fuel injection systems
   - Turbo chargers
   - Lubrication system
   - Cooling systems
2. Marine Diesel Engines Operation
   - Methods of starting and preparation
   - Indicator readings, faults, and remedial action
   - Refuelling 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
    - Operation and maintenance
    - Propulsion reversal
    - Common faults
    - Propeller types and attachment
5. Hydraulic Systems and Steering Gears
    - Mechanical and hydraulic steering systems
    - Operation principles
    - Pre-departure checks
    - Common faults
6. Pumping Systems
    - Bilge pumping system
    - Back flooding
    - Operation and common faults
    - Regular user maintenance
7. DC Battery Systems
    - Testing battery condition
    - Parallel and series connections
    - Safety precautions with batteries
    - Fuses and circuit breakers
8. AC Electrical and Distribution Systems
    - Generator operation
    - Safety precautions
    - Basic AC distribution system
9. 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
10. Ship construction and basic stability
    - Terminology
    - Hogging, sagging, and pounding
    - Collision and watertight bulkheads
    - Free surface effect
    - Longitudinal and transverse stability
11. Slipping and Survey
    - Periodic survey and maintenance

- Preparation and inspections
- Sacrificial anodes
- Stern tube bearings and tail shaft wear
- Rudder stock and pintle bearing wear

12. Deck Machinery & Maintenance
    - Operation of deck machinery
    - Dangers and safety
    - Routine maintenance
13. Refrigeration
    - Environment regulations
    - Basic mechanical refrigeration plant
    - Components
    - Operation and maintenance
    - Refrigerants

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

Learning Outcome 1 **Manage a marine diesel engine not exceeding 500 kW, in accordance with manufacturer recommendations, technical specifications, and safety requirements.**

Assessment Criteria

1.1 Operating cycle 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 a simple sea water cooling system and its components, including heat exchangers, are described

Conditions and Method of assessment

This section may be assessed on and off-the-job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels. Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments. Skill based criteria will be satisfied through practical exercises.

Assessment will be by a combination of:

- 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 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

This section may be assessed on and off-the-job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels. Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments. Skill based criteria will be satisfied through practical exercises.

Assessment will be by a combination of:

- 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	3.1	The basic construction of a marine outboard engine is explained
	3.2	Checks and procedures before starting an outboard is described
	3.3	Checks to be made if an engine fails to start are described.
	3.4	Warm up requirements are explained.
	3.5	Engine overheating and appropriate actions are explained.
	3.6	Routine user servicing is described

Conditions and
Method of assessment

This section may be assessed on and off-the-job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels. Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments. Skill based criteria will be satisfied through practical exercises.

Assessment will be by a combination of:

- 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	4.1	Reduction ratio is explained.
	4.2	Correct procedure of changing from ahead to astern is explained.
	4.3	Checks of the gearbox and drive train before sailing are described.
	4.4	Common operating faults that of a gearbox and drive train in service are identified.
	4.5	Maintenance of the drive train such as leaking stern glands, worn shaft bearings, and faulty couplings are identified and the remedial action described.

Conditions and

Method of assessment

This section may be assessed on and off-the-job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels. Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments. Skill based criteria will be satisfied through practical exercises.

Assessment will be by a combination of:

- 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

5.1 The main components of steering systems and the steering checks prior to sailing are explained.
5.2 Emergency steering systems and their correct operations are explained.
5.3 Common faults and remedial actions are described.
5.4 Safety precautions with hydraulic systems are described.
5.5 Operational checks and maintenance on a steering system are described.

Conditions and Method of assessment

This section may be assessed on and off-the-job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels. Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments. Skill based criteria will be satisfied through practical exercises.

Assessment will be by a combination of:

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

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	6.1	Components of a bilge pumping system are identified and their functions explained.
	6.2	Operation of an emergency bilge pump is described.
	6.3	The causes of "backflooding" and methods of prevention are explained.
	6.4	The corrective action to be taken if the bilge system is not working is described
	6.5	The correct procedure to change over from bilge duties to fire main duties on the vessel's general service pump is described
	6.6	User maintenance of the system is described.

Conditions and Method of assessment

This section may be assessed on and off-the-job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels. Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments. Skill based criteria will be satisfied through practical exercises.

Assessment will be 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

This section may be assessed on and off-the-job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels. Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments. Skill based criteria will be satisfied through practical exercises.

Assessment will be 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

8.1 The start up procedure of a generator and checks for correct operation are described.
8.2 Overloading of the generator and the correct operator actions are described.
8.3 Safety precautions when working with AC power supplies, possible causes of fatal electrical shock, and actions to be taken are identified.
8.4 Single phase AC power supply distribution and color coding of insulated wires are described.

8.5 Precautions and checks to be made before connecting the vessel to shore power are described.

8.6 Safety precautions to take when shore power is connected to the vessel on a slipway are described.

Conditions and Method of assessment

This section may be assessed on and off-the-job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels. Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments. Skill based criteria will be satisfied through practical exercises.

Assessment will be by a combination of:

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

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

9.1 Response to a machinery space fire alarm is described.

9.2 Inspection of fixed fire system in a small vessel's machinery space and survey requirements are described.

9.3 The safety precautions to be taken with petrol fumes and LPG leaks are explained

9.4 The actions to taken in case of an alarm indicating a LPG leak are explained.

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

This section may be assessed on and off-the-job. Competence may be assessed in the following

situations: classroom; laboratories; and appropriate vessels. Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments. Skill based criteria will be satisfied through practical exercises.

Assessment will be by a combination of:

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

Learning Outcome 10 **Describe the terms used in ship construction and basic stability.**

Assessment criteria

10.1 The terms used in basic ship construction for the main parts of the vessel are described.

10.2 The principles of basic stability are described.

Conditions and Method of assessment

This section may be assessed on and off-the-job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels. Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments. Skill based criteria will be satisfied through practical exercises.

Assessment will be by a combination of:

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

Learning Outcome 11 **Manage the engineering duties on board a vessel during docking operations, and maintain the stability and vessel integrity in accordance with safe and established procedures.**

Assessment criteria

11.1 The requirement for periodic maintenance and survey are described.

11.2 Preparations and inspections involved with slipping operations are described.

11.3 The function of sacrificial anodes and their locations are described.
11.4 Measurement of stern tube wear and its consequences are described.
11.5 The procedure of opening shipside valves for survey and the maintenance is described.
11.6 Rudderstock and pintle bearing wear is demonstrated or described.

Conditions and Method of assessment

This section may be assessed on and off-the-job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels. Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments. Skill based criteria will be satisfied through practical exercises.

Assessment will be by a combination of:

- Written assessment
- Calculations
- Assignments
- Oral 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 Routine maintenance of deck machinery is described.
12.4 The correct use of hand tools and the purpose of specialized tools are described.
12.5 The basis for the selection and safe use of lifting gear is described.
12.6 The temporary repair of a leaking cooling water pipe is explained.
12.7 The replacement of a leaking pipe flange joint is explained.

Conditions and Method of assessment

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

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

Assessment will be by a combination of:

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

Learning Outcome 13 **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

13.1 The main components of a refrigeration plant are identified.
13.2 Reasons for refrigeration plant cutting out and requiring re-setting are described.
13.3 Reasons for a refrigeration plant not reaching the required low temperature is described.
13.4 Safety and environmental precautions necessary with refrigerant gases are described.
13.5 Checks, start up, monitoring, and shut down of a refrigeration plant are described.

Conditions and Method of assessment

This section may be assessed on and off-the-job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels. Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments. Skill based criteria will be satisfied through practical exercises.

Assessment will be by a combination of:

- Written assessment
- Assignments
- Oral assessment
- Practical assessment

Delivery strategy

The module provides for delivery by 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 and 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 and outboard motors
- Appropriate models
- Electrical testing equipment
- Appropriate tools and safety equipment
- SPC 052 Learners Guide

Assessment Principles

Assessment in this course has been developed in line with the principles of competency based training.

A single assessment instrument may be used to assess more than one learning outcome. Details of assessment requirements are provided following each learning outcome.

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.