

## Outline

Outboard Lower Unit System  
Course Title

SE212  
Dept. & Course No.

### I. COURSE DESCRIPTION:

This course covers the principles of gear cases, power trim/tilt system, propellers and gear shifting system on a variety of outboard engines. The focus is on the gear case designs, measurements, overhaul procedures and reconditioning of all parts in modern outboard gear cases. Students should be able to troubleshoot, service and rebuild an outboard engine gear case and power trim and tilt systems.

II. SEMESTER CREDITS: 3

III. CONTACT HOURS PER WEEK: 1      6      7  
Lec                      Lab                      Total

IV. PREREQUISITES: SE122

V. Student Learning Outcomes:

VI. Course Contents:

Upon the completion of the course, the students will be able with 65% accuracy to:

1. Explain the function of the gear box (lower unit).
  - A. Lower Unit (Gear box)
    1. Drive shaft
    2. Forward gear
    3. Reverse gear
    4. Clutch dog
    5. Shifter & clutch dog
    6. Bearing carrier
    7. Prop shaft
2. Name and explain each part of the gear box.
3. Locate and service or repair each part of the system.
4. Demonstrate and explain how power and trim systems work.
  - B. Power Trim/tilt
    1. Shock absorber valve
    2. Manual release valve
    3. Trimming or tilting out
    4. Trimming or tilting in
    5. Trailer on shallow water
5. Describe various types of propellers.
  - C. Propellers
    1. Diameter
    2. Pitch
    3. Cutting edge
    4. Trailing edge
6. Demonstrate proper removal and installation techniques of the propeller.

7. Describe, troubleshoot, service and repair outboard shifting systems.

- D. Shifting system
1. Shift rod
  2. Shifter detent
  3. Shifter shaft
  4. Shifter cradle
  5. Clutch dog pin

## VII. MATERIALS AND EQUIPMENT

- A. Outboard engine of any kind
- B. 2 hp – 275 hp
- C. Impeller housing
- D. Impeller (Synthetic rubber)
- E. Sealant (Form a gasket type)
- F. Impeller key

## VIII. TEXTS

Required Text(s)

Roth, Alfred C. *Small Gas Engines*. South Holland, Illinois. The Goodheart-Wilcox, 2012.

## IX. METHOD OF INSTRUCTION

- A. Lecture
- B. Guest speaker
- C. Laboratory work
- D. Audio/Visual
- E. Demonstration/discussion
- F. Individualized instruction
- G. Reinforcement activities

## X. METHOD OF EVALUATION

The components with corresponding weight in percent included in the computation of the total grade:

Final Exam .....	15%
Mid-term .....	15%
Tests and homework .....	20%
Projects .....	<u>50%</u>
Total .....	100%

Transmutation of percent to letter grade is as follows:

- 90 – 100 = A  
80 - 89 = B  
70 - 79 = C  
65 - 69 = D  
0 - 64 = F

## TASK LIST

**SE212 Outboard Lower Unit System**  
Course No & Title

Credits: 1      2      96  
Lec      Lab      Total Lab Hrs.

SLO #1-3 24 hrs

1. Remove and install the gearbox
2. Service and maintain gearbox
3. Disassemble and reassemble
4. Inspect and replace worn parts in the gearbox

SLO #4 24 hrs

1. Remove and install hydraulic motor
2. Inspect manual release valve
3. Disassemble and reassemble trimming (in) and tilting (out)
4. Tune-up and troubleshoot

SLO #5-6 24 hrs

1. Remove and install propellers
2. Locate and use propeller chart to find right pitch, diameter for right engine horse power

SLO #7 24 hrs

1. Remove and inspect shifter cradle
2. Remove and install the shifter detent
3. Disassemble and reassemble clutch dog and pin
4. Inspect and replace shift rod if necessary

**Palau Community College**  
**SE212 Outboard Lower Unit Systems**  
**Course Learning Outcomes**

During the course experience, the **course learning outcomes** (CLOs) will be assessed through the use of signature assignments. A rating scale will be used to determine the students' proficiency level of each CLO using specifically aligned assignments. The numerical ratings of 4, 3, 2 and 1 are not intended to represent the traditional school grading system of A, B, C, D and F. The descriptions associated with each of the numbers focus on the level of student performance for each of the course learning outcomes listed below.

**Rating Scale:** 4 Outstanding  
 3 Proficient  
 2 Developing  
 1 Emerging

**CLO 1: Students will be able to carry out a full service of an outboard gear box as well as repair or replace any damaged parts.**

Outstanding 4	Can carry out a complete service on an outboard lower unit with no assistance from the instructor. Can successfully trouble-shoot a faulty lower unit and either rebuild or replace any damaged parts.
Proficient 3	Can carry out a complete service on an outboard lower unit with minimal assistance from the instructor. Can usually trouble-shoot a faulty lower unit and either rebuild or replace most damaged parts.
Developing 2	Can carry out a complete service on an outboard lower unit with constant assistance from the instructor. Can trouble-shoot major faults in a lower unit and assist with the rebuilding or replacement of faulty parts.
Emerging 1	Can assist an instructor with a service on an outboard lower unit. Can assist the instructor with troubleshooting faults in a lower unit and assist with the rebuilding or replacement of faulty parts.

**CLO 2: Students will be able to demonstrate and explain how a power trim system works.**

Outstanding 4	Fully understands and can explain the theory and principle of operation of an outboard power trim unit. Fully understands the operation of all power trim components. Can confidently service and repair an outboard power trim system without assistance.
Proficient 3	Understands and can explain the theory and principle of operation of an outboard power trim unit with minor errors. Understands the operation of most power trim components. Can service and repair an outboard power trim system with some assistance.
Developing 2	Understands the theory and principle of operation of an outboard power trim unit with minor errors. Understands the operation of some power trim components. Can service and repair an outboard power trim system with constant assistance.
Emerging 1	Understands the basic operation of an outboard power trim unit. Knows how a power trim system works. Can assist the instructor with the service and repair an outboard power trim system.

**CLO 3: Students will be able to identify and describe various types of propellers as well as remove and refit them.**

Outstanding 4	Can identify and describe a wide variety of propellers. Fully understands and can explain the theory and principle behind the shape of different propellers. Can competently remove, replace or refit a propeller without assistance.
Proficient 3	Can identify and describe a variety of propellers. Understands and can explain the theory and principle behind the shape of different propellers. Can remove, replace or refit a propeller with minor assistance.
Developing 2	Can identify and describe a few propellers. Understands the basic theory and principle behind the shape of different propellers. Can remove, replace or refit a propeller with constant assistance.
Emerging 1	Can identify some different types of propellers. Knows the basic principle behind the shape of different propellers. Can assist the instructor with the removal, replacement or refit of a propeller.

**CLO 4: Students will be able to trouble-shoot, service and repair the shifting systems for various outboards.**

Outstanding 4	Fully understands and can explain the theory and principle of operation of an outboard shifting system. Is able to trouble-shoot, service and repair a shifting system quite independently.
Proficient 3	Understands and can explain the theory and principle of operation of an outboard shifting system. Is able to trouble-shoot, service and repair a shifting system with some assistance
Developing 2	Understands the principle of operation of an outboard shifting system. Is able to trouble-shoot, service and repair a shifting system with constant assistance.
Emerging 1	Understands the basics of an outboard shifting system. Is able to assist the instructor with the service and repair a shifting system