Course Outline

Robotic 1	GE128
Course Title	Dep't. & Course No.

I.   COURSE DESCRIPTION

This course covers BASIC programing, assembly, testing, motor control, interfacing, sensing lights and sounds, and controlling the robot in a distance. Student will build their robot project that will give them the unique experience in estimation, wiring, source coding tuning and problem solving in robot navigation.

II.   SEMESTER CREDITS: 3 Credits

III.   CONTACT HOURS PER WEEK:

1	6	7
Lecture	Lab	Total

IV.   PREREQUISITE: GE116

V.   STUDENT LEARNING OUTCOMES:
At the end of the semester, the student with a combined accuracy of 65% should be able to:

COURSE CONTENT

1. Discuss the concept of operation of underwater robot.

A. Concept of Operation
   a. Motion
   b. Pressure
   c. Buoyance
   d. Electric Power

2. Explain how electronics controller works in underwater robot.

B. Electronics Controller
   a. Switches
   b. PCB board and wires
   c. Electronics Components

3. Discuss the steps in assembling the underwater robot.

C. Assembly parts
   a. Motors
   b. Wires
   c. Fames
   d. Camera
   e. Monitor

4. Explain how to test and tune-up the underwater robot.

D. Testing and Tuning

5. Identify the hardware and software parts of the land robot.

E. .Boe-Bot's Brain:
   a. Hardware and Software.
   b. Getting the Software

6. Install the programing software of the Boe-robot

7. Discuss the operation of the servo motor and how program it.

F. Boe-Bot's Servo Motors
   a. Building and Testing the LED Circuit
   b. Tracking Time and Repeating

c. Actions with a Circuit
d. Connecting the Servo Motors
e. Centering the Servos.
f. How To Store Values and Count
g. Testing the Servos

8. Discuss the steps in assembling and testing the Boe-robot.

G. Assemble and Test Your Boe-Bot
a. Assembling the Boe-Bot Robot
b. Re-Test the Servos

9. Write programs for controlling the speed of Boe-robot using debug terminals.

c. Start/Reset Indicator Circuit and Program
d. Testing Speed Control with the Debug Terminal

10. Discuss navigation system of Boe-robot.

H. Boe-Bot Navigation
a. Basic Boe-Bot Maneuvers
b. Tuning the Basic Maneuvers
c. Calculating Distances
d. Maneuvers-Ramping
e. Simplify Navigation with Subroutines
f. Advanced Topic—Building Complex Maneuvers in EEPROM

11. Write programs to navigate the Boe-robot.

I. Tactile Navigation with Whiskers
a. Building and Testing the Whiskers
b. Field Testing the Whiskers
c. Navigation with Whiskers
d. Artificial Intelligence and Deciding When You're Stuck

12. Discuss the operation of Photo sensors.

J. Light-Sensitive Navigation with Phototransistors
a. A Simple Binary Light Sensor
b. Measure Light Levels with Phototransistors
c. Light Sensitivity Adjustment
d. Light Measurements for Roaming

13. Explain how to integrate Photo sensors to Boe-robot.

e. Routine for Roaming Toward Light
g. Test Navigation Routine with the Boe-Bot

14. Discuss how Infrared light works to Boe-robot

K. Navigating with Infrared Headlights
a. Building and Testing the IR Object Detectors
b. Field Testing for Object Detection and Infrared

Interference
c. Infrared Detection Range
Adjustments
d. Object Detection and Avoidance
e. High-Performance IR Navigation
f. The Drop-Off

15. Discuss how to control Boe-robot with distance detection.

L. Robot Control with Distance Detection
a. Building and Testing the IR Object Detectors
b. Field Testing for Object Detection and Infrared Interference
c. Infrared Detection Range Adjustments
d. Object Detection and Avoidance
e. High-Performance IR Navigation
f. The Drop-Off Detector

VI. MATERIALS AND EQUIPMENT

- 4- 10'x ½ PVC water pipe
- 60 – Assorted PVC connectors
- 4- 100, 8 in 1 wire cable
- 4 – Marine Electronics Controller Kit
- 4 – Camera
- 4 – Portable LCD Monitor
- 4 – 12votls 5A DC Battery
- 1 - Boe-Bot Robot Chassis
- 2 - Parallax continuous rotation servos
- 2 - Plastic wheel and tire sets
- 1 - 1" tail wheel
- 1 - 4 AA Cell Battery Holder
- 2 - Whisker wires for touch sensors
- 2 - Phototransistors for light sensors
- 2 - IR Transmitter Assembly Kits
- 2 - Infrared Receivers for object sensors
- 2 - Pushbuttons, LEDs, and a piezo speaker
- 2 - Passive components (resistors, capacitors, 3-pin headers, and jumper wires)
- 2 - All the required hardware (screws, standoffs, spacers, nuts. washers, and grommets)
- 1 - BASIC Stamp Board of Education Full (USB)

VI.   TEXT AND REFERENCES
Required Text:
Andy Lindsay, **Robotics with Boe-Bot**, Parallax Inc,2011.

VIII.   METHOD OF INSTRUCTION

1. Lecture for the presentation of theory
2. Demonstration for the presentation of skills
3. Discussion and questioning for test of understanding
4. Practical experiments for emphasis of known principles
5. Project construction

IX.   METHOD OF EVALUATION

A. Lecture presentation will be tested using the written test method. Laboratory evaluation will be rated based on the following criteria.

1. Accuracy
2. Appearance
3. Completion
4. Techniques

B. The components with corresponding weight in percent included in the Computation of Midterm and Final grades are:

Participation 10%
Portfolio 10%
Quizzes/Homework 10%
Midterm/Final Examination 20%
Laboratory Performance/Project.... .... 50%
TOTAL = 100%

The transmutation of total percent to letter grade is as follows:

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

TASK LISTING SHEET

Robotic 1
Course Title

GE 128
Dep't. & Course No.

Credits: <u>1</u> <u>2</u> <u>96</u>
Lec Lab Total Lab Hrs

Laboratory Objectives	Time Allotment
1. Assemble the Marine Under Water Robot	36
1. Building the Frame 2. Assemble the Electronics Controller 3. Install and Camera and LCD monitor 4. Test and Tune-up the Robot	
2. Assemble and Test the Land Robot.	15
1.Boe-Bot's Brain: 2. Boe-Bot's Servo Motors 3. Assemble and Test Your Boe-Bot	
3. Control Robot Navigation.	15
1. Boe-Bot Navigation 2. Tactile Navigation with Whiskers	
4. Integrate Lights Sensor in Robot Navigation	15
1. Light-Sensitive Navigation with Phototransistors 2. Navigating with Infrared Headlights	
5. Control with distance detection.	15
1. Robot Control with Distance Detection	

Palau Community College
GE 128 Robotic 1
Course Learning Outcomes

During the course experience, the course learning outcomes (CLO) 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 rating 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 outcome listed below.

Rating Scale: 5 Excellent
4 Above-Average
3 Average
2 Below Average
1 Unacceptable

CLO 1: Assemble the Marine Under Water Robot.

5	Demonstrate knowledge and skills in building the frame, assembling the controller, installing the camera and monitor, and tuning the operation of the robot with no instruction or assistance from the supervisor.
4	Demonstrate knowledge and skills in building the frame, assembling the controller, installing the camera and monitor, and tuning the operation of the robot with no instruction but limited supervision..
3	Demonstrate knowledge and skills in building the frame, assembling the controller, installing the camera and monitor, and tuning the operation of the robot with some instruction and more than limited supervision..
2	Demonstrate knowledge and skills in building the frame, assembling the controller, installing the camera and monitor, and tuning the operation of the robot with considerable instruction and close supervision.
1	Unable to build the frame, assemble the controller, install the camera and monitor, and tune-up the operation of the robot even with close instruction and supervision. Little to no experience and knowledge in the area.

CLO 2: Assemble and Test the Land Robot.

5	Demonstrate knowledge and skills in assembling the land robot mechanical system, controller, interfacing motor and test the operation with no instruction or assistance from the supervisor.
4	Demonstrate knowledge and skills in assembling the land robot mechanical system, controller, interfacing motor and test the operation with no instruction but limited supervision..
3	Demonstrate knowledge and skills in assembling the land robot mechanical system, controller, interfacing motor and test the operation with some instruction and more than limited supervision..
2	Demonstrate knowledge and skills in assembling the land robot mechanical system, controller, interfacing motor and test the operation with considerable instruction and close supervision.
1	Unable to neither assemble the land robot mechanical system, controller, interfacing motor nor test the operation even with close instruction and supervision. Little to no experience and knowledge in the area.

CLO 3: Control Robot Navigation..

5	Demonstrate knowledge and skills in controlling the navigation of the robot with no instruction or assistance from the supervisor.
4	Demonstrate knowledge and skills in controlling the navigation of the robot with no instruction but limited supervision.
3	Demonstrate knowledge and skills in controlling the navigation of the robot with some instruction and more than limited supervision.
2	Demonstrate knowledge and skills in controlling the navigation of the robot with considerable instruction and close supervision.
1	Unable to control the navigation of the robot even with close instruction and supervision. Little to no experience and knowledge in the area.

CLO 4: Integrate Lights Sensor in Robot Navigation.

5	Demonstrate knowledge and skills in integrating lights sensor to the navigational system of the robot with no instruction or assistance from the supervisor.
4	Demonstrate knowledge and skills in integrating lights sensor to the navigational system of the robot with no instruction but limited supervision.
3	Demonstrate knowledge and skills in integrating lights sensor to the navigational system of the robot with some instruction and more than limited supervision.
2	Demonstrate knowledge and skills in integrating lights sensor to the navigational system of the robot with considerable instruction and close supervision.
1	Unable to integrate lights sensor to the navigational system of the robot even with close instruction and supervision. Little to no experience and knowledge in the area.

CLO5: Control with distance detection.

5	Demonstrate knowledge and skills in controlling the robot with distance detection with no instruction or assistance from the supervisor.
4	Demonstrate knowledge and skills in controlling the robot with distance detection with no instruction but limited supervision.
3	Demonstrate knowledge and skills in controlling the robot with distance detection with some instruction and more than limited supervision.
2	Demonstrate knowledge and skills in controlling the robot with distance detection with considerable instruction and close supervision.
1	Unable to control the robot with distance detection even with close instruction and supervision. Little to no experience and knowledge in the area.