Course Outline

Industrial Control Technology — Course Title

GE 217 — Dep't. & Course No.

I. COURSE DESCRIPTION

This course is designed to provide the students with fundamental knowledge and skills in industrial electronics circuits, applications, and control technology. It deals with wiring and installation of electric motors, repair and maintenance of field control devices such as industrial switches, relays, and transducers. It also includes PLC operation, setup, configuration, programming, and troubleshooting.

II. SEMESTER CREDITS: 3 Credits

III. CONTACT HOURS PER WEEK: 2 Lecture | 3 Lab | 5 Total

IV. PREREQUISITE: GE 116 & GE 124

V. STUDENT LEARNING OUTCOMES:

At the end of the semester, the student with a combined accuracy of 65% should be able to

1. Discuss the fundamentals of control system.
2. Explain how the different interface driver circuits and control devices works in a control system
3. Explain how the different modes of feedback system can reduced problems in control system.
4. Discuss how the AC and DC motor works
5. List the different types of AC and DC motors.
6. Discuss the maintenance procedures of AC and DC motor

VI. COURSE CONTENT

A. Introduction to Control Systems
- a. Introduction to Control Systems
- b. Analog and Digital Control Systems
- c. Classifications of Control Systems

B. Interface Driver Circuit
- a. Relay and Contactors
- b. Transistor driver circuit
- c. OP amp circuit
- d. Triac Driver Circuit
- e. SCR driver Circuit
- f. Optocoupler driver circuit

C. Feedback Control Principles
- a. Performance Criteria
- b. On-Off Controller
- c. Proportional Control
- d. Integral Control
- e. Derivative Control
- f. PID controllers

D. Actuators
- a. AC Motors
- b. DC Motors
- c. Electric Linear Actuators
- d. Hydraulic Systems

7. Discuss the operation of different linear actuators
8. Explain how Hydraulic and Pneumatic system works in a control system.
9. List the different control devices used in Hydraulic and Pneumatic technology and briefly discuss how they operate.

e. Pneumatic Systems
f. Flow Valves

10. List the different kinds of sensors and explain briefly how they works.

E. Transducers
a. Position transducers
b. Velocity transducers
c. Proximity transducers
d. Load transducers
e. Pressure transducers
f. Temperature transducers
g. Flow transducers
h. Liquid Level transducers

11. Discuss behavior and response of a mechanical components in a system

12. Explain the function of Gears and other transmitting technique in a control system

F. Mechanical Systems
a. Behavior of Mechanical Components
b. Response of Mechanical System
c. Gears
d. Other Transmitting Techniques

13. Discuss the development of PLC and its role to modern industrial controls system.

G. Introduction to Programmable Logic Controllers.
a. Historical Development
b. Principles of Operation
c. Typical Areas of Application
d. Product Ranges
e. Programmable Controller Familiarization

14. List some PLC manufacturer and their example PLC products.

15. Identify the different parts of PLC and explain their purpose.

H. The Hardware Component
a. The Controller Processor
b. The EPROM
c. The RAM
d. Memory Structure and Capacity
e. Input Module
f. Output Module

16. Discuss the different PLC Languages and how to used them

I. Programming Languages
a. Review of Machine Language and Codes
b. Ladder Diagram
c. Statement Listing
d. Function Block Diagram

17. Discuss how to setup and configure the PLC.

18. Discuss the steps in writing programs to PLC

J. Programming the Controller

a. Modes of Operation
b. Input Addressing
c. Output Addressing
d. Internal and External Relay Addressing
e. Counter Instructions
f. Timer Instructions
g. Sequencer Instructions
h. Program Development
i. Program Editing
j. Loading and Saving Programs

VII. MATERIALS AND EQUIPMENT

Three-phase Motors
40 W Lamps & Lamp Sockets
Electromagnetic Contactor
Stepper Motors
AWG #22 Solid Wire Connectors (insulated)
Solid-state Relays
Digital Trainer
Thyristors
Multi-tester
Optocoupler
Power Transistors
Transducer
Industrial control trainer kit
Banana Jack Connectors
Alligator Clip Connectors
PLC Units
Computer

VI. TEXT AND REFERENCES

A. Required Text:
Kilian, Christopher **MODERN CONTROL TECHNOLOGY,** USA: Delmar Publishing Company, 2006

IX. METHOD OF INSTRUCTION

B. Lecture for the presentation of theory
C. Demonstration for the presentation of skills
D. Discussion and questioning for test of understanding
E. Practical experiments for emphasis of known principles
F. Project construction

X. 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

INDUSTRIAL CONTROL TECHNOLOGY — Course Title

GE 217 — Dep't. & Course No.

Credits: 2 Lec 1 Lab 48 Total Lab Hrs

Laboratory Objectives	*Time Allotment*
A. Diagnose and repair problems of interface driver circuit and controller circuit	12
1. Assemble the Interface driver circuit. 2. Troubleshoot and repair the interface driver circuit.	
B. Diagnose and repair problems of actuators and Input/output devices	12
1. Wire AC motor and perform motor control a. On/Off control b. Forward and reverse control c. Jogging and Inching control d. Integrate timing control e. Star to Delta control 2. Wire DC motor and perform motor control a. Forward and reverse using relay and transistor b. Speed control c. Position Control 3. Integrate sensors to the motor control circuit. a. Over load protection device b. Limit switch c. Photo sensor d. Temperature sensor e. Pressure valve 4. Troubleshoot problems in the control circuit	
C. Setup and configure the PLC device	12
1. Wire the I/O devices to PLC 2. Setup and configure the parameters of PLC **3.** Test the operation of **PLC**	
D. Develop PLC programs	12
1. Watering the green house plants 2. Outdoor lighting system 3. Bending machine 4. School Bell system 5. Monitoring the parking lot 6. Controlling the shutter window	

Palau Community College
GE 217 INDUSTRIAL CONTROL TECHNOLOGY
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: Diagnose and repair problems of interface driver circuit and controller circuit.

5	Demonstrate knowledge and skills in locating and replacing the defective parts of the driver and controller circuit with no instruction or assistance from the supervisor.
4	Demonstrate knowledge and skills in locating and replacing the defective parts of the driver and controller circuit with no instruction but limited supervision..
3	Demonstrate knowledge and skills in locating and replacing the defective parts of the driver and controller circuit with some instruction and more than limited supervision..
2	Demonstrate knowledge and skills in locating and replacing the defective parts of the driver and controller circuit with considerable instruction and close supervision.
1	Unable to diagnose and repair problems of the interface driver circuit and controller circuit even with close instruction and supervision. Little to no experience and knowledge in the area.

CLO 2: Diagnose and repair problems of actuators and input/output devices.

5	Demonstrate knowledge and skills in identifying and replacing the defective actuators and I/O devices properly with no instruction or assistance from the supervisor.
4	Demonstrate knowledge and skills in identifying and replacing the defective actuators and I/O devices properly with no instruction but limited supervision.
3	Demonstrate knowledge and skills in identifying and replacing the defective actuators and I/O devices properly with some instruction and more than limited supervision.
2	Demonstrate knowledge and skills in identifying and replacing the defective actuators and I/O devices properly with considerable instruction and close supervision.
1	Unable to demonstrate knowledge and skills in identifying and replacing the defective actuators and I/O devices properly even with close instruction and supervision. Little to no experience and knowledge in the area.

CLO 3: Set up and configure the PLC device.

5	Demonstrate knowledge and skills in setting and configuring the PLC device with no instruction or assistance from the supervisor.
4	Demonstrate knowledge and skills in setting and configuring the PLC device with no instruction but limited supervision.

3	Demonstrate knowledge and skills in setting and configuring the PLC device with some instruction and more than limited supervision.
2	Demonstrate knowledge and skills in setting and configuring the PLC device with considerable instruction and close supervision.
1	Unable to set up and configure the PLC device even with close instruction and supervision. Little to no experience and knowledge in the area.

CLO 4: Develop PLC programs.

5	Demonstrate knowledge and skills in developing PLC programs with no instruction or assistance from the supervisor.
4	Demonstrate knowledge and skills in developing PLC programs with no instruction but limited supervision.
3	Demonstrate knowledge and skills in developing PLC programs with some instruction and more than limited supervision.
2	Demonstrate knowledge and skills in developing PLC programs with considerable instruction and close supervision.
1	Unable to develop PLC programs even with close instruction and supervision. Little to no experience and knowledge in the area.