

I. COURSE DESCRIPTION:

This course is an introduction to the principles of ProcessControl. The characteristics of controller modes and tuning will be studied in detail. The automatic control of process variables such as temperature, flow, level and pressure will be applied in the practical component of the course.

II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course, the student will demonstrate the ability to:

1. Describe Process Control and understand the related terminology and concepts.

Potential Elements of the Performance:

- Explain why automatic control is necessary in process industries
- Describe the criteria necessary for proper control.
- Understand the functional layout for a single variable control loop and explain the components.
- Define the terms:

a) Open Loop	g) Primary Element
b) Closed Loop	h) Primary Measuring Element
c) Feedback	i) Controlling Element
d) Feedforward	j) Final Control Element
e) Measured Variable	k) Disturbance
f) Controlled Variable	l) Direct acting-Reversr acting
- List and describe the main characteristics of a process loop.
- List the factors which contribute to the dynamic response of a single – variable control loop.
- Using ISA symbols draw the schematic diagrams for temperature, flow, level and pressure single variable feedback loops.

2. Explain the operation and characteristics of on-off control.

Potential Elements of the Performance:

- Sketch and describe an on-off controller.
- Describe the limitations of on-off control.
- Describe the function of the deadband.
- Describe the operation of a differential gap controller.

3. Describe the operational principles and characteristics of Proportional (Gain) Control.

Potential Elements of the Performance:

- Sketch and describe the operation of a pure proportional controller.
- Differentiate between gain and proportional band.
- Perform conversions between proportional band and gain.
- Describe offset as applied to proportional control.
- Explain how to reduce offset.
- Perform controller output calculations.
- State the limitations of a proportional controller.

4. Describe the operational principles and characteristics of Proportional plus Integral (Reset) Control.

Potential Elements of the Performance:

- Sketch and describe the operation of a proportional plus integral controller
- Differentiate between reset and integral action
- State the purpose of integral in a controller
- Describe the effect of integral on gain of a controller
- Perform controller output calculations
- Explain reset windup and anti-reset windup

5. Describe the operational principles and characteristics of Proportional plus Derivative (Rate) Control.

Potential Elements of the Performance:

- Sketch and describe the operation of a proportional plus derivative controller
- Describe the units of derivative control
- Perform controller output calculations
- Describe where and why derivative action is advantageous
- Explain the purpose of bumpless transfer

6. Introduction to controller tuning.

Potential Elements of the Performance:

- Explain the term quarter wave amplitude dampening
- Describe and perform the trial and error method of tuning
- Describe the Ziegler-Nichols reaction method of tuning
- Describe the Ziegler-Nichols continuous cycling Method of tuning
- Determine suitable controller settings
- Describe controller modes on typical processes

III. TOPICS:

1. Introduction to automatic control
2. Characteristics of on-off control
3. Proportional Control
4. Proportional plus Integral control
5. Proportional plus Derivative control
6. Introduction to controller tuning

IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Terry Bartlett 2nd Edition 2002 Delmar Publishing
 Industrial Control Electronics Devices, Systems and Applications
 Instrumentation Lab Manual and Assignments

V. EVALUATION PROCESS/GRADING SYSTEM:

The following semester grades will be assigned to students in postsecondary courses and other than post secondary courses:

Grade	Definition	<i>Grade Point Equivalent</i>
A+	90 – 100%	4.00
A	80 – 89%	3.00
B	70 - 79%	2.00
C	60 - 69%	1.00
D	50 – 59%	0.00
F (Fail)	49% and below	
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field /clinical placement or non-graded subject area.	
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.	
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.	
NR	Grade not reported to Registrar's office.	
W	Student has withdrawn from the course without academic penalty.	

VI. SPECIAL NOTES:Special Needs:

If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your instructor and/or the Special Needs office. Visit Room E1204 or call Extension 493 so that support services can be arranged for you.

Retention of course outlines:

It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

Plagiarism:

Students should refer to the definition of “academic dishonesty” in *Student Rights and Responsibilities*. Students who engage in “academic dishonesty” will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

Course outline amendments:

The Professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Substitute course information is available in the Registrar's office.

<include any other special notes appropriate to your course>

VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

VIII. DIRECT CREDIT TRANSFERS:

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.

