Miami Dade College

Course Competencies Template – Form 112

GENERAL INFORMATION	
Course Prefix/Number: EST2530C	Course Title: Process Control Technology
Number of Credits: 3	
Degree Type	☐ B.A. ☐ B.S. ☐ B.A.S ☐ A.A. ☒ A.S. ☐ A.A.S. ☐ C.C.C. ☐ A.T.C. ☐ V.C.C
Date Submitted: 09-05-2007	Effective Year/Term: 2007-2
☒ New Course Competency ☐ Revised Course Competency	
Course to be designated as a General Education course (part of the 36 hours of A.A. Gen. Ed. coursework): ☐ Yes ☒ No	
The above course links to the following General Education Outcomes: ☒ Communication ☒ Numbers / Data ☒ Critical thinking ☒ Information Literacy ☐ Cultural / Global Perspective ☐ Social Responsibility ☐ Ethical Issues ☒ Computer / Technology Usage ☐ Aesthetic / Creative Activities ☐ Environmental Responsibility	
Course Description (limit to 50 words or less): This course is designed for students studying systems and associated electronic circuits encountered in the field of electric machinery and industrial controls. Students learn to analyze systems and devices and perform calculations to determine parameters to accurately predict operation. Students examine the concepts and principles of open and closed loop systems, transducers, transformers, transmission, and distribution systems. Prerequisite: EET 1025C. Laboratory fee. A.S. degree credit only. (2 hr lecture; 2 hr lab)	
Prerequisite(s): EET1025C	Corequisite(s):

Course Competencies:

Competency 1. The student will demonstrate an understanding of the basic concepts of control technology by:

1. Explaining how a process control system works.
2. Identifying the elements of process control.
3. Defining and distinguishing between open-loop and closed-loop systems.
4. Interpreting and explaining control system block diagrams, including the components, their functions, and how they operate within the system.
5. Explaining transfer functions.
6. Differentiating between analog and digital controllers.
7. Defining servomechanisms and explaining how they work.
8. Identifying the operating components of a control system and explaining how they function within the system.

Revision Date: 09-24-2007

Approved By Academic Dean Date: _____ Reviewed By Director of Academic Programs Date: _____

Competency 2. The student will demonstrate a basic understanding of how to interpret the common instrument and line symbols and notations used on process control and loop diagrams by:

1. Explaining the function and use of block diagrams.
2. Sketching a typical loop diagram and explaining the purpose and function of each component.
3. Reading a block diagram, identifying each of the elements represented, and describing the process depicted in the diagram.
4. Identifying the function, measurement variable, location and accessibility, and loop identification of an instrument given its symbol and tag number.
5. Identifying the type of connection between an instrument and the process to which it is connected when given a tag number.
6. Identifying signal line types (pneumatic, electrical, capillary, or internal software link).
7. Specifying the type of valve actuator (diaphragm, motor, solenoid, or piston) when given a symbol.
8. Interpreting and explaining the information available in a typical process control diagram, title block, revision list, materials list, and notes block.
9. Interpreting the functional operation of the systems represented in typical process control diagrams.
10. Differentiating between loop diagrams and process diagrams, explaining the function of each type and their relationship to each other.
11. Identifying the location and type of each instrument port connection, junction box, and power source as well as the controller action for the instruments in a loop diagram.
12. Describing the functional operation of the systems represented in a typical loop diagram.

Competency 3. The student will demonstrate a basic understanding of how to use Electronic Test Devices for industrial process control by:

1. Listing the various types of electronic test devices that may be used for process control, explaining their basic functions in the control process, and describing how they operate.
2. Identifying safety procedures associated with the operation of electronic test devices.
3. Describing the function of each user control of a multimeter, zeroing the meter display of an analog multimeter, and measuring an electronic input value of a multimeter.
4. Describing the function of each user control of a multi-function electronic calibrator, measuring an electronic input value of a multi-function electronic calibrator, and generating an electronic value to test an instrument using a multi-function electronic calibrator.
5. Describing the features and operations of oscilloscopes and using them to measure and interpret waveforms.
6. Describing the function of the vertical input connector and coupling switch.
7. Describing the functions of the vertical gain control and of the vertical position.
8. Describing the operation of the trigger and the function of a probe.

Competency 4. The student will demonstrate an understanding of the principles of single-loop control and the applications of feedback control in the industrial environment by:

1. Defining terminology and explaining basic concepts used to describe process control.
2. Describing the basic elements of a process control system and identifying the system response to various control modes.
3. Interpreting an on/off control response curve and locating the dead zone or dead band.
4. Comparing and contrasting the action of a final control element in an on/off control system with a proportional control process.
5. Identifying reverse- or direct-acting control with an example of measurement and subsequent output response.
6. Determining the setting of the controller's proportional band and gain on a pictorial representation of process control action.
7. Identifying offset on an example of proportional only control.
8. Defining integral control and derivative control in relation to error signal.
9. Identifying minutes per repeat and repeats per minute with an example of the units used in integral control.
10. Defining reset wind-up on a process response curve for an integral controller.
11. Identifying the effects of reset wind-up on the elements of process control on a heat exchange system.

Competency 5. The student will demonstrate an understanding of the application of multiple-loop control strategies to industrial process control systems and the operation of several types of digital process control systems by:

1. Identifying the benefits of advanced process control strategies.
2. Comparing feedback and feedforward control.
3. Explaining the principles and applications of a feedforward control system.
4. Explaining the principles, applications, and benefits of cascade control, ratio control, adaptive, and selective control.
5. Discriminating between wild and controlled flows in a ratio control system.
6. Identifying the method of process control used in direct digital, supervisory, and distributed control systems.

Competency 6. The student will demonstrate an understanding of how to apply the principles of controller tuning by:

1. Defining controller tuning, common terminology and concepts, and its purpose as used in a process control system.
2. Explaining the basic procedures used to tune controllers.
3. Performing the preliminary steps for tuning a controller.
4. Stabilizing a process on manual control before using the ultimate method.
5. Obtaining the value of and calculating the proper setting for a proportional band or gain.
6. Finding the value of the ultimate period.
7. Calculating the proper Settings for PI, PD, and PID controllers.
8. Verifying adjustments.
9. Obtaining and interpreting a process reaction curve.

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10. Calculating the process gain, dead time, time constant, and controller settings using the reaction curve method.
11. Interpreting a process response to determine the proper setting.
12. Using the trial and error method to tune the proportional mode.

Competency 7. The student will demonstrate the ability to use frequency and temperature test devices by:

1. Selecting appropriate testing equipment when given specific processes and conditions for which to test.
2. Explaining the features of a temperature calibrator and how calibrator temperature and sensor type are configured.
3. Describing how calibrator output memories and ramp steps are configured.
4. Taking a reading of a thermocouple input.
5. Taking a reading of a 4-wire, 3-wire, and 2-wire resistance-temperature detector (RTD) input.
6. Connecting a calibrator to an instrument to simulate a thermocouple and outputting a thermocouple value.
7. Connecting a calibrator to an instrument to simulate an RTD and producing an RTD value.
8. Describing the operation and use of the sweep/function generator as an instrumentation test instrument.
9. Describing the switches, controls, displays, and indicators found on a sweep/function generator.
10. Demonstrating a proper variable symmetry operation.
11. Generating frequency input for a controller.