New Course Form

MET 210 Process Control and Instrumentation 3

Originator: Kenny Keith **Status:** Approved **Date Created:** 02/01/2013

Department: MET: Mechatronics **Submitted:** 02/05/2013 **Completed:** 02/27/2013

To ACETS:

Course Prefix: MET

Course Number: 210

Course Title: Process Control and Instrumentation

Cross-listing: No

Cross-listing information:

Semester for Implementation: Fall

Year of Implementation: 2013

Course Type: Required Transfer Vocational

Credit Hours: 3

Transfer Course: BAS-articulation discussions are underway

Course Catalog Description: This course covers the fundamentals of process control and instrumentation as applied in industry for the control of level, flow, temperature, and pressure.

Rationale: The concepts of process control and instrumentation are most often associated with continuous flow industries such as chemical processing and refining, however, as the science of automation and control advances, these concepts are being much more frequently applied across discrete and hybrid industries as well in an effort to keep manufacturing conditions and variables in a more precisely known state. Higher production rates require the continuous monitoring and control of the flow, temperature and pressure of substances including air, water, coolant, lubricant, adhesive, reactants, and ingredients. Knowledge in the area of process control and instrumentation is applicable across the full spectrum of industries. This course will provide the maintenance technician with the fundamentals for many of the applications in discrete and hybrid industries such as machining, assembly, food processing and packaging.

Total Lecture Contact Hours per Week: 2

Total Lab Contact Hours per Week: 3

Total Contact Hours: 75

Load Factor: 4.1

Requisites:	Yes
Prerequisites:	MET 130 Industrial Electrical Systems
Co-requisites:	
Mode of Instructional Delivery:	(1) Traditional classroom instruction (3) Hybrid: internet with live lab (5) Laboratory
If "other" mode of instruction, specify:	
Library Resources:	N/A
Assessment of Student Learning - Methods:	(1) Written Examinations (3) Oral Presentations (5) Demonstration of Skills
IF "other" assessment, specify:	
Recommend Course Enrollment:	15
Credit by Examination:	No
Literacy/ Critical Inquiry Component:	N/A
Ethnic/ Gender Awareness:	N/A
Sustainability:	No
Sustainability (explanation):	
COURSE TOPICS:	The concept of a control loop is introduced and each of the loop's components- sensor, controller and final element- are examined. Design, documentation, operation, performance tuning and troubleshooting of single loop systems is discussed.
COURSE OUTCOMES:	1.Describe proper safety procedures for working with process systems 2.Define process control; controlled and manipulated variables; open and closed loop control; manual control; automatic control; transducer; transmitter; converter; controller; final control element; sensor; specific gravity; sensitivity; accuracy; scaling; on/off control; time-proportional control; proportional control; steady state; transient state; upset; integral control; derivative control; proportional band; gain; reset; reset tune; reset rate; wind-up; resolution; accuracy; repeatability; temperature; internal energy; heat transfer; conduction; convection; radiation; thermal power 3.Describe the operation, function and application of level measurement, sight

gages
4.Describe the function and use of ISA block diagrams and instrument tags
5.Identify the common symbols, line types, notations and indexes of a Process and Instrumentation Diagram (P&ID)
6.Use the common symbols, line types, notations and indexes of a Process and Instrumentation Diagram (P&ID)
7.Power up a loop controller using a Honeywell UDC 3300
8.Configure a loop controller using a Honeywell UDC 3300
9.Calibrate a loop controller using a Honeywell UDC 3300
10.Tune a loop controller using a Honeywell UDC 3300
11.Operate a loop controller using a Honeywell UDC 3300
12.Connect current to pressure (I/P) converters for final control elements
13.Operate current to pressure (I/P) converters for final control elements
14.Calibrate current to pressure (I/P) converters for final control elements
15.Connect a diaphragm actuated proportional valve
16.Operate a diaphragm actuated proportional valve
17.Adjust a diaphragm actuated proportional valve
18.Describe methods of measuring liquid level including a bubbler and a pressure sensor
19.Convert between liquid level units, pressure units, sensor output units and display units
20.Demonstrate the ability to connect, operate, test and display level using a capacitance pressure sensor
21.Describe the function, operation, and application of ultrasonic level measurement
22.Demonstrate the ability to connect ultrasonic level sensors and apply in a closed loop system for level control
23.Demonstrate the ability to configure ultrasonic level sensors and apply in a closed loop system for level control
24.Demonstrate the ability to operate ultrasonic level sensors and apply in a closed loop system for level control
25.Describe the principles and operation of an on/off process control algorithm with alarms
26.Connect electronic controllers to implement tank level control and alarming using an on/off algorithm and discrete inputs and outputs
27.Configure electronic controllers to implement tank level control and alarming using an on/off algorithm and discrete inputs and outputs
28.Operate electronic controllers to implement tank level control and alarming using an on/off algorithm and discrete inputs and outputs
29.Use an electronic controller to control a process in proportional mode, proportional / integral mode, proportional / derivative mode and proportional / integral / derivative mode
30.Describe methods of measuring flow including turbine sensors and paddlewheel sensors
31.Convert between velocity, volumetric and mass flow rate units
32.Describe how differential pressure is used to measure flow, the types of sensors used, types of orifice plates and the operation and function of a DP transmitter
33.Describe the operation of flow nozzles, venture tubes, and pitot tubes

34.Measure flow using orifice plates, venture tubes and pitot tubes together with a differential pressure flow transmitter
35.Demonstrate the ability to construct and operate a flow control loop using DP
36.Demonstrate the ability to configure and implement a flow control loop using a paddlewheel sensor, a digital flow transmitter, a valve and a controller
37.Describe loop optimization
39.Calculate resolution and accuracy for a loop
40.Tune a loop using the process reaction curve open-loop method, the Ziegler-Nichols closed-loop method and an automatic method
41.Perform thermal energy calculations and conversions between temperature scales, energy units (BTU's Joules) and power units
42.Calculate the energy needed to raise the temperature of a substance and the heat transfer rate to raise the temperature of a flowing fluid
43.Describe the function, operation and application of heating elements, heat exchangers, chillers, thermostats and manual temperature controllers
44.Describe the functions, operation, issues and applications of thermocouples, two and three wire RTDs and two, three and four wire
45.Measure the outputs of thermocouples, RTDs and thermisters.
46.Demonstrate the ability to configure and implement a flow control loop using a paddlewheel sensor, a digital flow transmitter, a valve and a controller
47.Describe the function and operation of temperature transmitters
48.Configure transmitters for thermocouples, RTD's and thermisters
49.Connect transmitters for thermocouples, RTD's and thermisters
50.Demonstrate the ability to configure, connect and operate a controller for manual, on/off, time-proportional and proportional output control
51.Describe a distributed control systems (DCS) and its role in process control
52.Compare a DCS to a PLC and stand-alone instrumentation

Proposer: Kenny Keith