**BARTON COMMUNITY COLLEGE**

**COURSE SYLLABUS**

# **GENERAL COURSE INFORMATION**

Course Number: MEAS 1102

Course Title: Instrumentation and Controls

Credit Hours: 9

Prerequisite: None

Division/Discipline: Workforce Training and Community Education/ Gas Measurement Program.

Course Description: This instructor led and web based course enables the student to understand and operate instrumentation that monitors and directs processes including pressure, flow, temperature, level, and material composition. The student will learn to use a variety of different forms of instrumentation such as electrical, electronic, and computerized control devices such as programmable logic controllers.

# **INSTRUCTOR INFORMATION**

# **COLLEGE POLICIES**

Students and faculty of Barton Community College constitute a special community engaged in the process of education. The College assumes that its students and faculty will demonstrate a code of personal honor that is based upon courtesy, integrity, common sense, and respect for others both within and outside the classroom.

Plagiarism on any academic endeavors at Barton Community College will not be tolerated. The student is responsible for learning the rules of, and avoiding instances of, intentional or unintentional plagiarism. Information about academic integrity is located in the Student Handbook.

The college reserves the right to suspend a student for conduct that is determined to be detrimental to the College educational endeavors as outlined in the College Catalog, Student Handbook, and College Policy & Procedure Manual. (Most up-to-date documents are available on the College webpage.)

Any student seeking an accommodation under the provisions of the Americans with Disability Act (ADA) is to notify Student Support Services via email at disabilityservices@bartonccc.edu.

1. **COURSE AS VIEWED IN THE TOTAL CURRICULUM**

Gas Measurement technicians must have the skills necessary to install, maintain, and troubleshoot computerized instrumentation and controls. This course is a critical part of the training necessary to ensure the success of technicians competing for high tech positions in the natural gas measurement field.

# **ASSESSMENT OF STUDENT LEARNING**

Barton Community College assesses student learning at several levels:  institutional, program, degree and classroom.  The goal of these assessment activities is to improve student learning.  As a student in this course, you will participate in various assessment activities.  Results of these activities will be used to improve the content and delivery of Barton’s instructional program.

## Course Outcomes, Competencies, and Supplemental Competencies

1. Outline the purpose of instrumentation and controls in natural gas measurement.
2. List types of instruments and controls used in gas measurement.
3. Describe how properly calibrated instruments can increase revenue.
4. Explain environmental and safety awareness when working on pipeline instrumentation.
5. Define the instrumentation terms and units of measurement.
6. Define and list the differences between atmospheric, absolute, and gauge pressures.
7. Define and list the differences between Fahrenheit, Celsius, Rankine, and Kelvin temperatures.
8. Define volume, density, and specific gravity.
9. Explain how fluid properties are used to calculate flow.
10. List secondary measurement devices.
11. List the applications for manometers, bourdon tubes, diaphragms, orifice plates, and thermocouples.
12. Define zero suppression and elevation.
13. Explain a control loop and how it is used for process control.
14. Define the terms controlled variable, measured variable, and set point.
15. List and define the steps of process control, cascade control, and feedback control.
16. Summarize the four basic control elements in a control loop.
17. Define feedback and cascade control loops.
18. Operate and tune a control loop.
19. Define proportional, integral, and derivative (PID) functions in a control loop.
20. Calculate approximate tuning settings for a control loop given specified scenarios.
21. Predict the results of specified combinations of PID.
22. List the historical milestones of Programmable Logic Controllers (PLC).
23. Review the reasons for the development of the PLC.
24. List the manufacturers of PLCs at the forefront of development.
25. State the current level of PLC development as used in gas measurement.
26. Illustrate input and output (I/O) data in a PLC system.
27. Contrast digital and analog data.
28. State the functions of the PLC scan over one cycle.
29. Determine the correct radix for viewing digital and analog I/O.
30. Explain number systems used in a PLC.
31. Demonstrate uses for the decimal, binary, octal, and hexadecimal number systems.
32. Convert given decimal values to binary, octal, and hexadecimal.
33. Define the three addressing systems for a PLC-5.
34. List reasons for using 1 slot, 2 slot, or half slot addressing.
35. Show locations in PLC memory for given physical locations of I/O.
36. List the communications options for a PLC.
37. Demonstrate the loading of a driver in RSLinx.
38. List the data rates of DH-485, DH+, and RS-232.
39. List the interface devices for PLC communications.
40. Demonstrate how analog values are scaled.
41. State the range of a 12 bit analog I/O module.
42. Create Block Transfer programming for an analog channel.
43. Scale the analog values using math instructions.
44. Navigate to specified integer files to locate scaled analog data.
45. Create appropriate ladder logic per given operation descriptions.
46. Demonstrate AND, OR, NOT, and NOR logic using bit level instructions.
47. Create ladder logic for timing and counting functions.
48. Show functions for word and file moving instructions.
49. Demonstrate program control instructions.
50. Send and receive data using Message instructions.
51. Outline the data transmission process.
52. Illustrate the concepts of throughput, capacity, and compression ratio as they apply to data transmission.
53. Describe how capacity is measured.
54. Summarize telemetry and list its historical milestones.
55. Define and describe the concept of telemetry.
56. Describe advances in telemetry technology.
57. List key applications of telemetry.
58. Characterize the main types of network protocol.
59. Define major terms associated with network protocol.
60. Summarize the advantages associated with different types of network protocol.
61. Contrast network topologies.
62. List and contrast the types of network communication media.
63. Diagram a basic Ethernet network.
64. Contrast the properties of Controlnet and Ethernet.
65. List the properties of Devicenet.
66. Describe primary applications for Fieldbus.

1. **INSTRUCTOR'S EXPECTATIONS OF STUDENTS IN CLASS**
2. **TEXTBOOKS AND OTHER REQUIRED MATERIALS**
3. **REFERENCES**
4. **METHODS OF INSTRUCTION AND EVALUATION**
5. **ATTENDANCE REQUIREMENTS**
6. **COURSE OUTLINE**