**BARTON COMMUNITY COLLEGE**

**COURSE SYLLABUS**

# **GENERAL COURSE INFORMATION**

Course Number: MEAS 1104

Course Title: Flow Measurement

Credit Hours: 6

Prerequisite: None

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

Course Description: This instructor led and web based course prepares the student to install, maintain, and troubleshoot all industry standard gas measurement devices. The student will also learn how to interpret data from popular brands of flow computers and modify software parameters for specified applications.

# **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.

# **COURSE AS VIEWED IN THE TOTAL CURRICULUM**

In the natural gas industry, precision of measurement is second in importance only to safety. Because profit and potential losses can be directly related to measurement accuracy, gas companies insist that their technicians have a high level of training in installation, maintenance, and troubleshooting of gas measurement devices. This course contains the core intent of the gas measurement program.

1. **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. Explain meter selection and why it is important.
2. List common gas measurement meter types.
3. Identify appropriate meter selection for a given application.

1. Identify features of the Bristol and Fisher-ROC models of gas flow computers.
2. List historical milestones of electronic flow measurement.
3. Define primary, secondary, and tertiary elements.
4. List communications options for the Bristol and Fisher-ROC flow computers.
5. Summarize operation of a high speed counter.
6. List features of the Fischer-ROC Flo-Boss 107
7. List elements of accurate orifice measurement.
8. Describe the effects of error accumulation in gas measurement.
9. Interpret charts showing costs of orifice plate and differential pressure errors.
10. Detail how pressure differential relates to orifice measurement.
11. List the gas laws relating to orifice measurement.
12. Explain Beta Ratio and its effect on differential pressure.
13. Summarize regulations AGA-3, AGA-7, and AGA-9.
14. Identify which AGA regulation pertains to a given type of flow meter.
15. Interpret flow calculations used in given AGA regulations.
16. Define continuity of flow as it applies to gas flow.
17. Define mean velocity.
18. Define volumetric flow rate.
19. Calculate volumetric flow rate given mean velocity and cross sectional area.
20. Define laminar flow and turbulent flow as they apply to natural gas.
21. Contrast laminar and turbulent flow.
22. Explain how the Reynolds Number determines whether a flow is laminar or turbulent.
23. Compare laminar flow to the aerodynamics of an airplane wing.
24. Explain the Reynolds Number as it applies to gas flow.
25. Illustrate the Reynolds Number ratio.
26. Contrast inertia and viscosity.
27. Define the boundary layer and its role in pressure drop.
28. Detail the functions of primary and secondary elements in orifice measurement.
29. Define the vena contracta.
30. Detail how flow rate is determined in an orifice meter.
31. Explain Beta Ratio and its effect on differential pressure.
32. List common problems encountered with flow measurement using orifice plates.
33. Explain how edge sharpness, nicks, and flatness affect flow measurement.
34. List parameters to check when performing meter tube inspections.
35. Explain how meter tube length affects flow measurement.
36. Explain how meter tube diameter affects flow measurement.
37. List the quality criteria for choosing a meter tube pipe.
38. Describe the operation of turbine meters.
39. Contrast inferential and direct measurement meters.
40. State the flow equation for turbine meters.
41. Explain the effect the rotor has on the exit angle of the gas for both ideal and real turbine meters.
42. Define K-Factor.
43. Identify the components of turbine meter runs, and accessories.
44. Distinguish how each of the various parts of the generic turbine meter contributes to its operation.
45. Identify the purpose of the nose cone.
46. Define the function of the annular passage.
47. List the types of flow conditioners.
48. Detail the importance of Bypass and Block Valves at meter runs.
49. Interpret the requirements of field/factory proving, and calibration.
50. Compare the accuracy curve, linearity, and pressure loss.
51. List the steps for turbine meter calibration.
52. Define the determination of calibration factor.
53. List elements of correct turbine meter maintenance.
54. Interpret a graph of maintenance requirements.
55. List steps for rotor wobble test.
56. List steps for spin time test.
57. Interpret the bearing inspection table.
58. Summarize steps of turbine meter troubleshooting.
59. Correlate correct techniques to given turbine problem symptoms.
60. Define terms used for ultrasonic flow meters.
61. Show examples of custody transfer meters.
62. Relate gas laws to functions of ultrasonic flow meters.
63. Detail how ultrasonic signals are used to measure flow.
64. Explain the theory of Bounce Path meters.
65. Detail how the speed of sound is used to calculate flow.
66. List features of common ultrasonic flow meters.
67. List Instromet meter design criteria.
68. List features of the Uniform Software.
69. List alarm codes and errors.
70. Explain the Daniel USM theory of operation.
71. Summarize the two parts of a Daniel USM installation.
72. List causes of common failures of ultrasonic meters.
73. Outline maintenance and inspection requirements for ultrasonic meters.
74. List steps for an installation inspection.
75. List the steps for scheduled inspection.
76. Detail the frequency output check.

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**