# 11/7/2020

# brcc keystone logo

Baton Rouge Community College

*Academic Affairs Master Syllabus*

Date Approved: 3 September 2020

Term and Year of Implementation: Spring 2021

**Course Title:** Instrumentation Level 4

**BRCC Course Rubric:** INST 1419

**Previous Course Rubric**: INST 2413, INST 2423, and INST 2433

**Lecture Hours per week-Lab Hours per week-Credit Hours**: 3-12-9

**Per semester: Lecture Hours-Lab Hours-Instructional Contact Hours**: 45-180-225

**Louisiana Common Course Number:**

**CIP Code:** 15.0404

**Course Description:** Covers the National Center for Construction Education and Research (NCCER) Instrumentation Level 4 Modules 1 - 7. Successful completion of this course requires passing the NCCER Level 4 Modules 1 - 7 Exams with a 70% or higher. This course requires an exam fee.

**Prerequisites:**  INST 1326

**Co-requisites:** None

**Suggested Enrollment Cap:** 20

**Learning Outcomes.** *Upon successful completion of this course, the students will be able to:*

1. Describe the calibration process and the five-point method of calibration.

2. Describe pneumatic and analog calibration equipment and basic calibration procedures.

3. Describe the basic concepts and elements of digital logic circuits, including memory elements, counters, arithmetic elements, and decoders.

4. Describe basic PLC systems with a comparison to hardwired systems, various number systems corresponding to PLCs, languages used to program PLCs, and PLC hardware components.

5. Describe a DCS and the different hardware components that form the complete system, such as fieldbuses, servers, and human-machine interfaces.

**Assessment Measures.** Assessment of all learning outcomes will be measured using the following methods:

1. Practical demonstrations and skills performances

2. Quizzes and tests

3. NCCER Instrumentation Level 4 Modules 1 - 7 Exams

**Information to be included on the Instructor’s Course Syllabi:**

* ***Disability Statement*:** Baton Rouge Community College seeks to meet the needs of its students in many ways. See the Office of Disability Services to receive suggestions for disability statements that should be included in each syllabus.
* ***Grading:*** The College grading policy should be included in the course syllabus. Any special practices should also go here. This should include the instructor’s and/or the department’s policy for make-up work. For example in a speech course, “Speeches not given on due date will receive no grade higher than a sixty” or “Make-up work will not be accepted after the last day of class”.
* ***Attendance Policy*:** Include the overall attendance policy of the college. Instructors may want to add additional information in individual syllabi to meet the needs of their courses.
* ***General Policies*:** Instructors’ policy on the use of things such as beepers and cell phones and/or hand held programmable calculators should be covered in this section.
* ***Cheating and Plagiarism*:** This must be included in all syllabi and should include the penalties for incidents in a given class. Students should have a clear idea of what constitutes cheating in a given course.
* ***Safety Concerns:*** In some courses, this may be a major issue. For example, “No student will be allowed in the lab without safety glasses”. General statements such as, “Items that may be harmful to one’s self or others should not be brought to class”.
* ***Library/ Learning Resources:*** Since the development of the total person is part of our mission, assignments in the library and/or the Learning Resources Center should be included to assist students in enhancing skills and in using resources. Students should be encouraged to use the library for reading enjoyment as part of lifelong learning.

**Expanded Course Outline:**

I. Instrument Calibration and Configuration

A. Calibration Process and the Five-Point Method

a. Calibration process

b. Five-point method of calibration and the related documentation requirements

B. Pneumatic and Analog Calibration Equipment and Basic Calibration Procedures

a. Pneumatic calibration equipment and basic calibration procedures

b. Analog calibration equipment and basic calibration procedures

C. Smart Transmitters and Their Calibration Process

a. Various communication protocols and devices used for communication

b. Calibrating highway addressable remote transducer (HART) devices

D. Calibrating Transducers and Control Valve Positioners

a. Calibrating transducers

b. Calibrating Pneumatic, electro-pneumatic, and smart control valve positioners

II. Proving, Commissioning, and Troubleshooting a Loop

A. Inspecting Loop Components and Performing Continuity Checks

a. Visually inspecting various loop components

b. Conducting loop continuity tests on electrical and pneumatic devices

B. Proving and Calibrating a Loop

a. Proving a loop

b. Calibrating a loop

C. Commissioning a Loop

a. Documents associated with commissioning a loop

b. Commissioning process

D. Fundamental Steps in Loop Troubleshooting and the Troubleshooting Process

a. Fundamental steps in loop troubleshooting

b. Loop troubleshooting process for oscillating loops

III. Tuning Loops

A. Tuning and Basic Proportional Control Concepts

a. Importance and function of loop tuning

b. Basic proportional control and terms relevant to tuning

B. Equations Needed for Loop Tuning and Loop Tuning Processes

a. Basic equations needed for loop tuning

b. Open loop tuning processes

c. Closed loop tuning processes

d. Visual loop tuning process

IV. Digital Logic Circuits

A. Concepts and Elements of Digital Logic Circuits

a. Digital logic technology and terminology

b. AND, OR, XOR, and NOT gates

c. NAND, NOR, and XNOR gates

d. Combination logic and its purposes

B. Memory Elements and their Function in Digital Circuits

a. Basic flip-flop design

b. Operation of clocked logic and clocked flip-flops

c. Functions of various other types of registers

C. Counters and their Function in Digital Circuits

a. Numbering systems related to digital circuits

b. Function of binary counters

c. Function of other types of counters

V. Programmable Logic Controllers (PLCs)

A. PLCs and Comparing them to Hardwired Systems

a. Basic PLCs and systems

b. Comparison between PLCs and hardwired systems

B. Number Systems that Correspond with the Digital Operation of PLCs

a. Binary number system

b. Hexadecimal number system

c. Binary coding

C. PLC Hardware Components

a. Typical Power Supplies

b. Operation of processors

c. Operation of I/O and communication modules

D. PLC Programming Concepts

a. Programming languages used to program PLCs

b. Ladder diagramming and the six related categories of instruction

c. Guidelines for PLC programming and installation

VI. Distributed Control Systems (DCSs)

A. Evolution of a DCS and Its Relationship to Other Kinds of Control Systems

a. What is a DCS?

b. Evolution of DCS technology

c. Comparison of a DCS to other types of control systems

B. Components and Systems Related to DCSs

a. Hardware components of a typical DCS

b. Servers and workstations used with DCSs

c. DCS fieldbuses, networks, and communications protocols

d. Human-machine interfaces used with DCSs

C. Maintenance of DCS Technology

a. Considerations for preventive and/or periodic instrument maintenance

b. Considerations and approaches to the calibration and repair of instrumentation

c. Expertise in the servicing of instrumentation and how information can be obtained

d. Security issues associated with a DCS and how they can be addressed

VII. Analyzers and Monitors

A. Basic Chemistry Concepts and Key Characteristics of Compounds and Solutions

a. Basic Properties of elements and compounds

b. Chemical bonding and reactivity

c. Solutions and concentration

d. Acids, bases, pH, and salts

B. Density, Specific Gravity, Viscosity, and Turbidity

a. Properties of density and specific gravity and methods to analyze them

b. Properties of viscosity and methods to analyze it

c. Properties of turbidity and methods to analyze it