Brazosport College

Syllabus for INTC 1443 - Application of Industrial Automatic Control

Instructor: **Office:**
Office Phone: **Email:**
Alt. Phone:

I. COURSE DESCRIPTION:

INTC 1443 - Application of Industrial Automatic Control CIP 1504040011
A study of automatic process control in industrial plants including measuring devices, analog and digital instrumentation, signal transmitters, recorders, alarms, controllers, control valves, and process and instrument drawings. Hands on hookup and troubleshooting of a single loop to multicontrol loops will be included. **Credit Hours:** 4 (2 lecture, 2 lab)

January 2022

A. **Prerequisite*:*** Grade of "C" or better in **INTC 1441**. May be taken concurrently with **INTC 1441** with a grade of "B" or better in **INTC 1401**.
Required skill level: College - level reading and writing. Math: College-level with corequisite (placement code 3).

II. COURSE OBJECTIVES

At the conclusion of the course the following should have occurred:

1. Given the Emerson DeltaV and ABB 800 System documentation the student will discuss the similarities and differences between the two systems and their major functional areas for configuration, operation, and maintenance.
2. Demonstrate comprehension of hardware rack power, loop signals and communication requirements for the Emerson DeltaV and ABB 800 systems.
3. Demonstrate proficiency in interpreting, checking, correcting, and creating Piping and Instrumentation Drawings for different control configurations.
4. Perform calculations for resistance voltage and current for instrumentation installations and series / parallel resistive loads.
5. Perform conversions between instrument readings and their associated percent of range values.
6. Correct usage of instrumentation loop sheets and system displays in regard to configuration, calibration and troubleshooting control loops in a Digital Control System environment.
7. Discuss and diagram the control wiring configuration used at the PET and PGU units including the system switching relays used.
8. Interpret and troubleshoot the control configuration of the PGU boiler.
9. Demonstrate familiarity with flame detection systems.
10. Sketch failsafe alarm circuits.
11. Discuss digital control system alarms along with alarm rationalization.
12. Discuss intrinsically safe circuitry for instrumentation.
13. Discuss safety instrumented systems and their testing.
14. Discuss programmable electronic systems with different voting configurations.

15. Conform to electrical area classifications and management of change requirements.

16. Demonstrate the proper use of HART Communicators and associated DCS screens while working with transmitters and control valves.

17. Demonstrate proficiency in converting between different number systems that may be employed (Binary, Octal, Hexadecimal and Decimal).

18. Evaluate and sketch open loop timing charts for action, gain, reset and rate.

19. Determine the correct action of controllers as applied in specific loops.

20. Discuss on / off and time proportional control applications.

21. Demonstrate familiarity with Proportional Band, Integral, & Derivative settings and their equivalent representations as Gain, Reset & Rate.

22. Discuss and give examples of Feed Forward, Cascade and Ratio control configurations.

23. Perform correct interpretations of SAMA function block symbology with regard to High / Low selects and limits.

24. Draw Boolean Logic symbols and their respective truth tables.

25. Perform correct interpretations of a standard Lead-Lag Air- Fuel Ratio Control application with regard to normal operation and troubleshooting.

26. Reconfigure a simple level or temperature loop into a cascade control loop using flow as the secondary controller.

27. Determine the correct product ratio value given a standard ratio control loop and transmitter calibrations.

28. Evaluate proper operation for analysis control of condensate purity monitoring.

29. Evaluate proper operation of three element boiler feed water control.

30. Discuss and demonstrate control loop tuning procedures with regard to pretuning checks, Step Change, Tuning Map and Ziegler Nichols methods with the use of Simtronics Simulators.

31. Demonstrate and discuss the operation of Simtronics Simulations for Basic Control, Ratio, Cascade, pH, and Feed Forward controls.

32. Demonstrate familiarity with various configuration formats: Pick & Choose, Function Block, Ladder Logic, Structured Text, and Sequential Function Charts.

33. Configure a schematic diagram for either Pump Up or Pump Down Level control using either level or pressure switches.

III. STUDENT LEARNING OUTCOMES

End-of-Course Outcomes: Explain pneumatic and electronic controls; connect and troubleshoot control loops; and draw process and instrument diagrams wiring diagrams, and block diagrams.

IV. TEXTBOOK OR COURSE MATERIAL INFORMATION

1. No textbook, materials provided by instructor
2. Calculator TI-30XIIS (required)
3. Visorgogs Safety Glasses (required)

Required course materials are available at the Brazosport College bookstore, on campus or online at http://brazosport.edu/bookstore/home.html. A student of this institution is not under any obligation to purchase a textbook from the college bookstore. The same textbook is/may also be available from an independent retailer, including an online retailer.

For Distance Education Courses include the following: Contact the Brazosport College Bookstore with a credit card for course materials. Phone: 979-230-3651. Fax: 979-230-3653. Email:bookstore@brazosport.edu. Website: http://brazosport.edu/bookstore/home.html

B. Course Outline

This is a sample outline which may vary with individual instructors. It will also vary on whether the course is a summer course or a fall/spring course. Students should contact their instructor of the outline of the course they are taking.

WEEK	TOPIC
1	Demonstrate proficiency in interpreting, checking, correcting, and creating Piping and Instrumentation Drawings for different control configurations. Perform calculations for resistance voltage and current for instrumentation installations and series / parallel resistive loads.

2	Perform calculations for resistance voltage and current for instrumentation installations and series / parallel resistive loads. Correct usage of instrumentation loop sheets and system displays in regard to configuration, calibration and troubleshooting control loops in a Digital Control System environment
WEEK	**TOPIC**
3	Sketch failsafe alarm circuits. Discuss digital control system alarms along with alarm rationalization. Discuss intrinsically safe circuitry for instrumentation. Demonstrate proficiency in converting between different number systems that may be employed (Binary, Octal, Hexadecimal and Decimal).
3	**Test 1**
4	Discuss safety instrumented systems and their testing. Discuss programmable electronic systems with different voting configurations. Conform to electrical area classifications and management of change requirements. Determine the correct action of controllers as applied in specific loops.
5	Discuss and diagram the control wiring configuration used at the PET and PGU units including the system switching relays used. Interpret and troubleshoot the control configuration of the PGU boiler. Discuss on / off and time proportional control applications.
6	Draw Boolean Logic symbols and their respective truth tables.
7	Given the Emerson DeltaV and ABB 800 System documentation the student will discuss the similarities and differences between the two systems and their major functional areas for configuration, operation, and maintenance.
8	Demonstrate comprehension of hardware rack power, loop signals and communication requirements for the Emerson DeltaV and ABB 800 systems.
8	**Test 2**
9	Perform correct interpretations of SAMA function block symbology with regard to High / Low selects and limits. Configure a schematic diagram for either Pump Up or Pump Down Level control using either level or pressure switches.
10	Reconfigure a simple level or temperature loop into a cascade control loop using flow as the secondary controller.
11	Discuss and give examples of Feed Forward, Cascade and Ratio control configurations. Determine the correct product ratio value given a standard ratio control loop and transmitter calibrations. Evaluate proper operation for analysis control of condensate purity monitoring. Evaluate proper operation of three element boiler feed water control.
12	Demonstrate and discuss the operation of Simtronics Simulations for Basic Control, Ratio, Cascade, pH, and Feed Forward controls.
13	Demonstrate the proper use of HART Communicators and associated DCS screens while working with transmitters and control valves. Demonstrate familiarity with various configuration formats: Pick & Choose, Function Block, Ladder Logic, Structured Text, and Sequential Function Charts.

14	**Test 3**
15	Review for Final
16	**Final**

Important Semester Dates:
Last Day to Withdraw from Classes– Check BC Academic Calendar at http://catalog.brazosport.edu/index.php

Office Hours:
For fulltime faculty, office hours may change from semester to semester. Current faculty office hours are included on the syllabus, see link: https://brazosport.edu/faculty-and-staff/resources/course-syllabi-instructor-information/

For an adjunct faculty, no office hours are required, and they are not assigned an office. To set up an appointment with an adjunct, contact the instructor as per the email address on the syllabus, see link: https://brazosport.edu/faculty-and-staff/resources/course-syllabi-instructor-information/

V. STUDENTS WITH DISABILITIES

Brazosport College is committed to providing equal education opportunities to every student. BC offers services for individuals with special needs and capabilities including counseling, tutoring, equipment, and software to assist students with special needs. For student to receive any accommodation, documentation must be completed in the Office of Disability Services. Please contact Phil Robertson, Special Populations Counselor at 979-230-3236 for further information.

VI. TITLE IX STATEMENT

Brazosport College faculty and staff are committed to supporting students and upholding the College District's non-discrimination policy. Under Title IX and Brazosport College's policy FFDA (Local), discrimination based on sex, gender, sexual orientation, gender identity, and gender expression is prohibited. If you experience an incident of discrimination, we encourage you to report it. While you may talk to a faculty or staff member at BC, please understand that they are "Responsible Employees" and must report what you tell them to college officials. You can also contact the Title IX Coordinators directly by using the contact information below. Additional information is found on the Sexual Misconduct webpage at www.brazosport.edu/sexualmisconduct.

Alex Crouse, Director of Student Life and Title IX Coordinator
979-230-3355; alex.crouse@brazosport.edu

Mareille Rolon, HR Coordinator and Deputy Title IX Coordinator
979-230-3303; mareille.rolon@brazosport.edu

VII. ACADEMIC HONESTY

Brazosport College assumes that students eligible to perform on the college level are familiar with the ordinary rules governing proper conduct including academic honesty. The principle of

academic honesty is that all work presented by you is yours alone. Academic dishonesty including, but not limited to, cheating, plagiarism, and collusion shall be treated appropriately.

Academic dishonesty violates both the policies of this course and the Student Code of Conduct. In this class, any occurrence of academic dishonesty will be referred to the Dean of Student Services for prompt adjudication, and may, at a minimum, result in F, in this course.

Sanctions may be imposed beyond your grade in this course by the Dean of Student Services. Please refer to the Brazosport College Student Guide for more information. This is available online at http://brazosport.edu/students/for-students/student-services/.

VIII. ATTENDANCE AND WITHDRAWAL POLICIES

Class attendance contributes to your final grade, but you must attend class to successfully complete the course. If you are unable to complete this course, you must complete and submit a withdrawal form with the registrar's office. If the student decides to drop out of the class, it is the responsibility of the student to initiate a withdrawal before the withdrawal deadline in order to get a "W" on their transcript. If this is not done the student will receive a grade based on test grades and class grades earned during their attendance and absence (i.e., zeros on all missed materials, exams, skills tests, and final exam).

IX. COURSE REQUIREMENTS AND GRADING POLICY

TESTING MAKE-UP POLICY

Lecture and laboratory participation.....20%
Major examinations 40%
Final examination.....40%

The student will be graded in accordance with established college policy.

Grades are assigned as follows:

Grade	Final Average
A	90-100
B	80-89
C	70-79
D	60-69
F	Below 60

X. STUDENT CONDUCT STATEMENT

Students are expected to be aware of and follow the Brazosport College Student Code of Conduct. Students have violated the Code if they "fail to comply with any lawful directions, verbal or written, of any official at BC." Lawful directions include precautions and requirements taken to prevent the spread of COVID-19 at Brazosport College. Students who do not follow safety requirements, including the wearing of a mask, may be removed from class by their instructor and referred to the Dean of Student Services.

XI. CAMPUS CLOSURE STATEMENT

Brazosport College is committed to the health and safety of all students, staff, and faculty and adheres to all federal and state guidelines. The College intends to stay open for the duration of the semester and provide access to classes and support services on campus in the safest way possible. The College will also comply with lawful orders given by applicable authorities, including the Governor of Texas, up to and including campus closure. It is possible that on campus activities may be moved online and/or postpone if such orders are given.

XII. STUDENT RESPONSIBILITIES

Students are expected to fully participate in this course. The following criteria are intended to assist you in being successful in this course:

1. Understand the syllabus requirements
2. Use appropriate time management skills
3. Communicate with the instructor
4. Complete course work on time, and
5. Utilize online components (such as Desire2Learn) as required.

XIII. OTHER STUDENT SERVICES INFORMATION

Information about the Library is available at http://brazosport.edu/students/for-students/places-services/library/about-the-library/ or by calling 979-230-3310.

For assistance with online courses, an open computer lab, online and make-up testing, audio/visual services, and study skills, visit Learning Services next to the Library, call 979-230-3253, or visit http://brazosport.edu/students/for-students/places-services/learning-services/

For drop-in math tutoring, the writing center, supplemental instruction and other tutoring including e-tutoring, visit the Student Success Center, call 979-230-3527, or visit http://brazosport.edu/students/for-students/student-success-center/

To contact the Physical Sciences and Process Technology Department call 979-230-3618.

The Student Services provides assistance in the following:

Counseling and Advising	979-230-3040
Financial Aid	979-230-3294
Student Activities	979-230-3355

To reach the Information Technology Department for computer, email, or other technical assistance call the Helpdesk at 979-230-3266.

Get the information you need – when you need it. Click http://geni.us/BRAZO to install **BC Connect** on your mobile device to receive reminders, explore careers, map your educational plan, be in the know about events, find out about scholarships, achieve your goals and much more.