

**COURSE OUTLINE**  
**CET 222 Building Automation System Controls and Programming**  
**3 Credit Hours**

**Course Description**

This course builds on electrical and basic control concepts taught in CET 111 and introduces students to controllers that are commonly used in building systems. Students will learn how these controllers communicate with equipment and other controllers, and they will learn how to interpret and write basic programming code in three formats: a graphical interface for block programming, line code, and ladder logic code.

**Prerequisite(s)**

CET 101 OSHA 30 GENERAL INDUSTRY (CET)

CET 111 AC/DC Circuits I or HVA 1104 Electrical Fundamentals

**Purpose of Course**

The purpose of this course is to prepare students to work with controllers and control systems in buildings, including critical environments, and to troubleshoot problems that might involve programming code.

**Required Materials**

- Gaddis, Tony. 2019. *Starting Out with Programming Logic and Design*. 5<sup>th</sup> ed. Pearson. ISBN 9780134801155.

**Optional Resources**

- Petruzella, Frank D. 2017. *Programmable Logic Controls*, 5<sup>th</sup> ed. McGraw Hill. ISBN:978-0-0733-7384-3
- Gaddis, T. (2010). *Starting out with ALICE* (2<sup>nd</sup> ed.). Boston, MA: Addison-Wesley Publishers. ISBN #: 978-0321545879
- Gaddis, T. (2010). *Starting out with Java* (4<sup>th</sup> ed.). Boston, MA: Addison-Wesley Publishers. ISBN #: 978-0136080206

**Learning Outcomes**

The intention is for the student to be able to:

1. Demonstrate understanding of the relationships between hardware and programming
  - a. Describe the differences between application controllers and Building Automation System controllers.
  - b. Describe how computers input, output, and store data.
  - c. Explain the differences between system and application software.
2. Design a program flowchart
  - a. Define the program task.
  - b. Develop pseudocode.
  - c. Build a flowchart.
3. Identify and use common data types in programming.

- a. Declare and dimension variables in at least two different programming languages.
  - b. Identify variables as Boolean, string, integer, or double.
4. Use common program organizing techniques.
  - a. State reasons that good documentation is important.
  - b. Add comments to code.
  - c. Develop a program using modules.
5. Interpret and use common programming structures.
  - a. Develop and interpret truth tables for programs comprising the logical operators, such as AND, OR, XOR, NOT.
  - b. Develop a program using a simple loop structure and a nested loop structure.
  - c. Develop a program using a function that receives and passes variable values.
6. Interpret and write simple programs using different programming languages.
  - a. Write a program using graphical block programming.
  - b. Write a program using line code.
  - c. Write a program using ladder logic.
  - d. Identify elements of object-oriented programming.
7. Demonstrate an understanding of the architecture, operation, advantages and disadvantages of a Building Automation System.
  - a. Explain the difference, advantages, and disadvantages between central supervisory control and distributed control.
  - b. Explain the relationship between a Building Automation System and application-specific controllers.
  - c. Write code to turn a cooling unit on and off based on a temperature reading and a temperature setpoint.

**Learning Units**

- I. Hardware and Programming
- II. Program Design
- III. Data Types
- IV. Program Organization
- V. Programming Structures
- VI. Programming Languages
- VII. Building Automation Systems Programming

**Method of Delivery/Instruction**

☒ Face-to-Face                      ☒ Blended                      ☐ Online

Learning activities will be assigned within and outside the classroom or online to assist the student to achieve the intended learning outcomes through lecture, Instructor-led class discussion, hands-on experiences, and others at the discretion of the instructor.

**Method of Grading and Evaluation**

The student will be graded on learning activities and assessment tasks. Grade determinants may include the following: daily work, quizzes, chapter or unit tests, comprehensive examinations, student projects, student presentations, class participation or forum posts, and other methods of evaluation employed at the discretion of the instructor.