Course Number and Title: NRG 223 Energy Control Strategies

Campus Location:
Georgetown, Dover, Stanton

Effective Date:
2018-51

Prerequisite:
NRG 126

Co-Requisites:
none

Course Credits and Hours:
3.00 credits
2.00 lecture hours/week
2.00 lab hours/week

Course Description:
This course covers building system control theory, sequences, and controlled device selection criteria. The effects on system performance are analyzed. An emphasis is placed on identifying and understanding control strategies related to HVAC equipment and components. Modifications in control sequence of operations are evaluated, and calculations are employed to estimate energy savings.

Required Text(s):
Obtain current textbook information by viewing the campus bookstore - https://www.dtcc.edu/bookstores online or visit a campus bookstore. Check your course schedule for the course number and section.

Additional Materials:
None

Schedule Type:
Classroom Course

Disclaimer:
None

Core Course Performance Objectives (CCPOs):

1. Engage in professional behavior. (CCC 1, 3, 4, 5)
2. Apply control theory to commercial HVAC systems and components. (CCC 1, 2, 6; PGC BAS 2, 3, 6, NRG 2, 5)
3. Examine common control sequences, and select sequences to optimize the energy performance of HVAC systems. (CCC 1, 2, 5, 6; PGC BAS 3, 6; NRG 3, 5)
4. Optimize control and system performance by selecting appropriate controlled devices (valves and dampers). (CCC 2, 6; PGC BAS 5, 6, NRG 5)
5. Calculate the effect that selected sequences have on system performance, and predict energy savings resulting from employing each one. (CCC 1, 2, 3, 4, 6; PGC BAS 3, 6, NRG 3, 5)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

Measurable Performance Objectives (MPOs):
Upon completion of this course, the student will:

1. Engage in professional behavior.
    1. Demonstrate punctuality when attending class, participating in off-site projects, and submitting assignments.
    2. Communicate using industry-appropriate language during presentations, reports, and homework.
    3. Demonstrate appropriate professional behavior when working with others.
2. Apply control theory to commercial HVAC systems and components.
    1. Examine two-position control.
    2. Recognize when and explain how two-position control is applied.
    3. Examine and describe floating control.
    4. Explain the application of floating control.
    5. Describe proportional control.
    6. Predict the effect of integral and derivative tuning characteristics on proportional control operations.
    7. Select controlled devices based upon response characteristics.
3. Examine common control sequences, and select sequences to optimize the energy performance of HVAC systems.
    1. Identify and discuss control strategies for central plant equipment.
    2. Examine ladder and block diagrams for control logic.
    3. Create a single-line diagram to illustrate sequence of operation.
    4. Identify and discuss control strategies for central station air handling units (AHUs).
    5. Compose a diagram to illustrate control points and sequence of operations for AHUs.
    6. Read and interpret control sequences for central plant equipment.
    7. Identify and analyze central plant equipment sequence modifications for energy savings.
4. Optimize control and system performance by selecting appropriate controlled devices (valves and dampers).
    1. Examine velocity flow ratings of valves and the impact on system performance.
    2. When given system parameters of flow and pressure drop, select the appropriate valve for the application.
    3. Categorize the most common types of dampers and their operation.
    4. Select the appropriate damper for optimum system performance when given the specific application.
5. Calculate the effect that each sequence has on system performance, and predict energy savings resulting from employing each one.
    1. Create a baseline energy model that incorporates equipment energy efficiencies at part load conditions.
    2. Calculate the energy usage of various components in multiple operating conditions using binned weather data or hourly weather data.
    3. Analyze various component and system control sequence changes to calculate energy reduction and potential cost savings.
    4. Select and employ sequences that result in the most efficient operation of the entire system to predict total energy savings for the proposed changes.
    5. Prepare a report to make recommendations for control sequence implementation, supported by calculated energy and cost saving.

Evaluation Criteria/Policies:
Students must demonstrate proficiency on all CCPOs at a minimal 75 percent level to successfully complete the course. The grade will be determined using the Delaware Tech grading system:

92	**–**	**100**	**=**	**A**
83	**–**	**91**	**=**	**B**
75	**–**	**82**	**=**	**C**
0	**–**	**74**	**=**	**F**

Students should refer to the Student Handbook - https://www.dtcc.edu/handbook for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

Core Curriculum Competencies (CCCs are the competencies every graduate will develop):

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):
Building Automation Systems

1. Utilize building system and energy technology hardware and software to gather data on building lighting systems operation and energy consumption.
2. Utilize building system and energy technology hardware and software to gather data on heating, ventilation, and air conditioning (HVAC) systems operation and energy consumption.
3. Evaluate commercial buildings and make recommendations for optimized building performance and occupant comfort.
4. Prepare and present technical reports.
5. Assemble, install, service, and repair direct digital controls (DDC) for building electrical and mechanical systems.
6. Program and explain operational sequences for building equipment and systems.
7. Integrate and commission building systems and components to ensure reliable performance and compliance building codes.

Energy Management

1. Utilize building system and energy technology hardware and software to gather data on building lighting systems operation and energy consumption.
2. Utilize building system and energy technology hardware and software to gather data on heating, ventilation, and air conditioning (HVAC) systems operation and energy consumption.
3. Calculate, analyze, and verify the energy use of buildings based upon the interaction of energy consuming building systems.
4. Evaluate residential buildings and make recommendations for optimized building performance and occupant comfort.
5. Evaluate commercial buildings and make recommendations for optimized building performance and occupant comfort.
6. Prepare and present technical reports.
7. Analyze the economic, environmental, and business implications of potential energy measures.

Disabilities Support Statement:
The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the disabilities services - https://www.dtcc.edu/disabilitysupport web page or visit the campus Advising Center.