SUSTN-101 COURSE

MILWAUKEE AREA TECHNICAL COLLEGE
TECHNICAL AND APPLIED SCIENCES (MATC/T&AS)

Sustainable Facilities Operations Program

SUSTN-101 Environmental Control Technician

National Science Foundation - National Center for Building Technician Education

2014-06-26

COURSE TITLE, SUSTAINABLE BUILDING CORE CONCEPTS

Course Documentation

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Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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Table of Contents

Catalog description

This 8 week accelerated course prepares the student to upgrade, operate and maintain energy management systems and related software and components. The controls used in this course are the latest technologies on the market. While the course focuses on the technological aspects of an energy controls technician, it also addresses customer service and proposal writing.

Class hours

24 hours of lecture and 24 hours of self-directed research.

Self-directed research is part of each homework assignment, see sample in Appendix C.

Units

3 Credits

Entry skills needed

The following are required for admission to the course:

- A high school diploma or GED
- Demonstration of proficiency in basic skills through a course placement assessment
- Course requires computer skills in word processing, spreadsheets, and Power Point.

In addition, your potential for success in the program will be enhanced if you have:

- Work experience
- Strong interest in sustainability and facilities management.
- Possess conceptual abilities, and problem-solving skills
- Be computer literate
- And have organizational skills.

Syllabus

See Appendix A for sample syllabus, course schedule, and policies. For lesson topics to include in course, see Exit Skills.

Student learning outcomes

The exit skills listed in the next section support these 3 outcomes:

Outcome #1

The student will gain a comprehensive understanding of computerized automation systems within commercial buildings.

Outcome #2

A student will gain a comprehensive understanding of mechanical HVAC systems.

Outcome #3

A student will be able to use building automation systems interface to operation maintain, and diagnose a buildings operating performance.

Exit skills

Course content to achieve outcomes listed above:

Exit Skill #1

1. Being able to utilize a building automation system to manage a facility.

   Lesson Topics:
   - Log into a BAS
   - Navigate the user interface
   - Ability to start / stop various mechanical equipment
   - Modify set points
   - Over-ride field devices
   - View historical data.
   - View and acknowledge alarms

Exit Skill #2

2. Develop an open building automation system architecture (being able to construct a system architecture that incorporates current communication technologies such as Bacnet, Lonworks, and Niagara framework.)

Lesson Topics:

- Design of a field bus protocol.
- Determining a number of nodes per segment
- Required end of line terminations
- Design of network area controller Ethernet network.
- Design of global data passing
- Design of enterprise architecture
- Design of enterprise connectivity
- Remote connectivity requirements.

Exit Skill #3

3. Ability to document sequences of operations for mechanical equipment in commercial buildings

Lesson Topics:

- Review of air handling unit ductwork and components
    - Constant volume AHU
    - Variable Air Volume AHU
- Review of variable air volume terminal boxes ductwork and components
    - Cooling only mode
    - Electric reheat
    - Hot water reheat
    - Parallel fan
    - Series fan
- Review of hydronic heating systems piping and components
    - Boiler system
    - Heat exchanger systems
- Review of hydronic cooling systems piping and components
    - chiller system
    - cooling tower system

Course materials

Principal text

Building Automation: Control Devices and Applications. (2008). Homewood, Ill.: American Technical Publishers.

Lecture materials and handouts

Refer to Appendix B for an example

- Presentations (PowerPoint): (from DVD)

    1. Introduction to Building Automation
    2. Electrical System Control Devices and Applications
    3. Lighting System Control Devices and Applications
    4. HVAC System Control Devices
    5. HVAC System Applications
    6. Plumbing System Control Devices and Applications
    7. Fire Protection System Control Devices and Applications
    8. Security System Control Devices and Applications
    9. Access Control System Control Devices and Applications
    10. Voice-Data-Video (VDV) System Control Devices and Applications
    11. Elevator System Control Devices and Applications
    12. Automated Building Operation

Other reference materials

None

Software needed

Access to computer with:

- Microsoft Office Programs (Word, Excel, PowerPoint, etc.).
- Adobe Reader (for pdfs). Price: Free. Source: www.adobe.com.
- Access to computer with internet access. (i.e. Internet Explorer, Google, Mozilla Firefox, Safari, etc.).

Lab setup and materials

A lab set up with air handling units and variable air volume boxes controlled with a building automation system (Metasys is used by MATC).

Equipment & instruments required

See lab setup.

Sample of weekly assignments

Questions in back of each chapter in the book are used. Refer to the book.

Project

None

Assessment

Methods

- 25% Test: Typically each test or Chapter Review is weighted the same.
- 50% Homework: Typically each Homework is weighted the same.
- 25% Class Participation: There will be various activities each day in class that require you to submit work in class. If you are not there, late or leave early there is no opportunity to make it up.
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Sample test questions

Pre-test and final exam. See CD provided with instructor copy of book.

Adaptability to on-line format

This course cannot be delivered on-line due to all the lab work required. Hands on use of control systems are integral to the students learning of the materials.

Appendix A – Sample syllabus

Course Title

MILWAUKEE AREA TECHNICAL COLLEGE
Course Syllabus

Spring, 2014

Course: *Environmental Controls Technician*		**Credits:** *3*
Subject Abbreviation: SUSTN	**Course Number:** 101	**Section Number:** 600A
Class Meets: *In E114b Mondays, 5:45 PM to 8:40 PM: March 24th – May 19th, 2014*		
Instructor: *Roland Gutknecht*		
Office:	**Office Hours:** *Available upon request*	
Phone number: (*414) 507-0999*	**E-mail:***gutknecr@matc.edu or roland.gutknecht@thinkESI.com*	
Course Description*: This course prepares the student to upgrade, operate, and maintain energy management systems and related software and components. The controls used in this course are the latest technologies on the market. While the course focuses on the technological aspects of an energy controls technician, it also addresses customer service as well.*		
Prerequisites: *None*		
ADA Statement: If you have a disability that impacts your classroom performance and wish to request an accommodation, contact the Office of Student Accommodations (414)297-6838. They may require documentation regarding your disability to enable them to comply with your request. Admission of a disability is voluntary and will be handled in a confidential manner. MATC does not discriminate against individuals with disabilities and fully complies with the Americans with Disabilities Act. To ensure your academic success in this program, you are strongly encouraged to provide your instructor with a copy of the Instructor Notification Form from the Office of Student Accommodations. This should be done at the beginning of the semester.		
Textbook(s): *Building Automation: Control devices and applications* PLEASE NOTE: In the event that the MATC book store does not carry any of the above texts, students may purchase their copies through the online vendors or book stores of their choice. **Supplies:** *None*		
Attendance Policy: Miss first two classes and you are automatically withdrawn from the class! Attendance will be taken on a daily basis. Students are expected to attend class regularly and to arrive on time. It is the student's responsibility to discuss absences with the instructor and follow up with an email. No email, no consideration for an excused absence. When an absence occurs, the student is responsible for making up the work. Work can be found in Blackboard. As a general rule, no exceptions for not meeting due dates are given for being absent. If there is an exception, it has to be detailed in a response from the instructor to your email explaining the absence. Miss 4 classes and you will be withdrawn from the course.		
Tests/Assignments Make-up Policy: ***It is the responsibility of the student to keep track of work and grades. In Blackboard, the "MyGrades" tab can be very helpful to check on completed work and view your grades. Ignorance of not knowing an item was due is not an excuse.*** Any late work will have 5% taken off for each day it is late. For instance, a chapter review done the morning of class will be considered one day late. Five percent will be taken off the score. So, if a score of 13 points out of 15 is awarded for that chapter review, then 13/15= .867 or 86.7%. Five percent will be taken off, or 87%-5% = 81.7% for a final score. Any item over two weeks late is not accepted and the student will receive a zero for that grade. There can be extenuating circumstances but these have to be discussed and agreed upon in writing by both parties at the time the work is due, not after the two week period.		

Assessment Activities: note: assessment activities are subject to change as the semester progresses.

- **Test:** *These are "tests" taken in class that are simply going over the reading material for that week and covering items from lectures/class. It is assumed that the student reads the chapter first.*
- **Homework:** *There are several homework items that are assigned during the semester to help with understanding of the course materials.*
- **Class Participation:** *There are activities, such a question answered the first minute of class (and handed in right away) that are part of each class. If you are not in class when that item is submitted, there is no making it up.*

Grading Standards: note: grading standards are subject to change as the semester progresses.

- **25% Test:** *Typically each test or Chapter Review is weighted the same.*
- **50% Homework:** *Typically each Homework is weighted the same.*
- **25% Class Participation:** *There will be various activities each day in class that require you to submit work in class. If you are not there, late or leave early there is no opportunity to make it up.*

Grading scale is as follows:

A - 4.00	Superior	for grades between 94% and 100%
A- 3.75		for grades between 90% and less than 94%
B+ 3.25	Above Average	for grades between 87% and less than 90%
B - 3.00		for grades between 84% and less than 87%
B- 2.75		for grades between 80% and less than 84%
C+ 2.25	Average	for grades between 77% and less than 80%
C - 2.00		for grades between 74% and less than 77%
C- 1.75		for grades between 70% and less than 74%
D+ 1.25	Below Average	for grades between 67% and less than 70%
D - 1.00		for grades between 64% and less than 67%
D- 0.75		for grades between 60% and less than 64%
U - 0.00	Unsatisfactory/Failing	for grades less than 60%

Instructor Support: Students are encouraged to contact the instructor before or after class, and during office hours, if they have questions or problems related to the class. It is suggested that students contact the instructor immediately in order to avoid falling behind in class. Please do not wait until the end of the semester to discuss issues that should have been resolved much earlier.

Academic Support Services: In addition to obtaining course-related assistance from the instructor, students may obtain assistance from the Academic Support Centers located at the Milwaukee, North, South, and West campuses. These centers are open to all MATC students. Services include, but are not limited to, assistance in computer applications, course assignments, Internet use, math, science, social studies, study skills, and writing. Please call the Academic Support Center at your campus for more information.

Instructor Recommended Withdrawals: You may be dropped for absenteeism when:

1. You are absent three consecutive classes.
2. Your attendance is sporadic (e.g., you miss three class periods), and you are unable to make up the instruction missed.
3. You fail to meet attendance requirements of licensing agencies.
4. You pose a safety hazard to yourself or others because of missed instruction critical to safe class or lab performance.
5. You are unable to make up instruction missed in a lab/shop class.
6. You have not attended class during the first two weeks of the term.

Dropping or Changing Courses: Students who are considering dropping the course should first discuss this with their instructor, counselor, or faculty advisor before dropping. They may be able to recommend an alternative course of action. Please be aware that dropping a course could result in a student being placed on warning or suspension at the end of the semester. Also, please be aware that dropping a course does not mean you will be refunded.

Students who wish to drop a course may voluntarily withdraw from the course up to two weeks before the last day of the semester. Course Change forms are available in the Registration office at the Milwaukee Campus or in Student Services at the regional campuses.

Students who do not report for the final examination (or presentation) and does not formally withdraw nor arrange for an incomplete grade, will be given a U grade for the course.

Incompletes: A grade of Incomplete may be granted, at the discretion of the instructor, in cases where the student has completed at least 75% of the course with a C or better at the time the Incomplete is requested. Students must complete the

Incompletes: A grade of Incomplete may be granted, at the discretion of the instructor, in cases where the student has completed at least 75% of the course with a C or better at the time the Incomplete is requested. Students must complete the missing work within one semester or else the Incomplete grade will revert to a U.
Student Complaint Procedure: MATC has established a formal system to assist students in resolving academic problems and course-related issues. In order for a complaint to be valid, the following steps must be followed in order: Step 1: Meet with the instructor to discuss any questions related to the course (e.g., requirements or assignments) or if you are experiencing academic problems. If the issue is unresolved after meeting with the instructor, Step 2: Meet with the associate dean of the department. If the issue is unresolved after meeting with the associate dean, Step 3: Meet with the dean of the department. If the issue is unresolved after meeting with the dean, Step 4: Go to the Office of Student Life for assistance.
Retention Alert: MATC is interested in the success of all of its students. Retention Alert is a tool that instructors, along with the counseling and advising department, use to help improve student success. There are three areas of Retention Alert: financial, personal/confidential, and retention. Retention Alert is designed to identify students who may be at risk of academic difficulty or failure as early as possible. Throughout the semester, an instructor may create Retention Alerts or referrals for some of their students. After a referral is made, the student will be contacted by someone by phone or email to discuss resources or set up an appointment to meet in person. The Retention staff follows up with the student and the student's instructor to facilitate support efforts. Prevention and intervention are key with students so timing and resources are important. With Retention Alert, hopefully students can get the help they need, when they need it.
OTHER IMPORTANT INFORMATION: No cell phones, no texting, no ear buds or other head phone set up, no computers. Please refer to the links in Blackboard under the "Syllabus" tab. Those links are: • Student Code of Conduct • Student Accommodation Services • Student Handbook

Classroom and Homework Activities:
Week 1 – Chapter 1: Introduction to Building Automation
Homework – Answer chapter 1 questions, read chapter 2
Week 2 – Review chapter 1
Chapter 2: Electrical System Control Devices and Applications
Homework – Answer chapter 2 questions, read chapter 3
Week 3 – Review chapter 2
Chapter 3: Lighting System Control Devices and Applications
Homework – Answer chapter 3 questions, read chapter 4
Week 4 – Review chapter 3
Chapter 4: HVAC System Control Devices
Homework – Answer chapter 4 questions, read chapter 5
Week 5 – Review chapter 4
Chapter 5: HVAC System Applications
Homework – Answer chapter 5 questions, read chapters 6-8
Week 6 – Review chapter 5
Chapter 6: Plumbing System Control Devices and Applications
Chapter 7: Fire Protection System Control Devices and Applications
Chapter 8: Security System Control Devices and Applications
Homework – Answer assigned questions from chapters 6-8, read Chapters 9 and 12
Week 7 – Review chapters 6-8
Chapter 9: Access Control System Control Devices and Applications
Chapter 12: Automated Building Operation
Homework – Answer chapter 9 and chapter 12 questions
Week 8 – Review chapters 9 and 12
Final Exam

Appendix B – Sample Power Point

Refer to DVD from the instructor copy of the book.

Appendix C – Sample Homework

Refer to DVD from the instructor copy of the book.

Appendix D – Sample Quiz

Refer to DVD from the instructor copy of the book.

BEST Center Curricula, Resources & Recordings

Academic Programs
Georgia Piedmont Technical College - Building Automation Systems
Milwaukee Area Technical College - Sustainable Facilities Operations
Laney College - Commercial HVAC Systems
City College San Francisco - Commercial Building Energy Analysis & Audits

Professional Development Materials, Presentations & Videos
National Institutes
Building Automation Systems Instructor Workshops
Webinars (e.g., BEST Talks)

Faculty Profile Videos
Reports & Case Studies
Marketing Resources

BEST
Building Efficiency for a Sustainable Tomorrow

NSF National Science Foundation