

COURSE OUTLINE
CET 121 Building Systems & CET: Electrical Systems & Lighting
2 Credit Hours

Course Description:

This course builds upon knowledge of electrical fundamentals and is designed to introduce the student to operation and automation components of electrical and lighting systems in industrial and critical environments. Schematics and blueprints will be used to encourage students to think from a systems perspective.

Prerequisite(s):

Purpose of Course: The purpose of this course is to prepare students to work on equipment in buildings that have sophisticated electrical and/or lighting systems.

Required Materials

Textbook: Selected chapters: ATP Staff. 2008. *Building Automation: Control Devices & Application*. ATP. ISBN: 978-0-8269-2000-3
Green, Gosse. 2017. *Industrial Maintenance & Troubleshooting*, 4th. ATP. ISBN: 978-0-8269-3686-8

Learning Outcomes

The intention is for the student to be able to:

1. Demonstrate an understanding of the types and scale of different power generation facilities.
 - a. Describe the basic process for different types of power generators: coal-fired, engines, gas-turbine, photovoltaic, wind.
 - b. List the fuel source, advantages and disadvantages of each type of power plant.
2. Demonstrate an understanding of how power is transferred from a central power plant to end users.
 - a. Identify major components of power distribution on a diagram and describe function of each.
 - b. Explain why voltage transformers are needed in power generation.
3. Demonstrate an understanding of why and how a local facility can operate its own backup or supplemental power facility.
 - a. Recall reasons a building might require a secondary power source.
 - b. List types of onsite energy generation systems that can be used for backup or supplemental power.
4. Demonstrate an understanding of the function of major components of a building electrical system.
 - a. Draw and define common symbols used in electrical schematics and building blueprints.
 - b. Match electrical components on a schematic to physical counterparts in a building or photo.
 - c. Explain the function of the following components of a building electrical systems: switchboards, panelboards, switches, fuses, circuit breakers, transformers, receptacles, outlets.
 - d. Explain and give examples of how a grounding system and overcurrent protection work.
 - e. State the function of an electrical switch, transfer switch, relay, and variable frequency drive.
5. Demonstrate an understanding of how electrical systems are monitored to optimize building performance.
 - a. Classify the various aspects of electricity that can be monitored (voltage, current, frequency, harmonics, noise, unbalance).
 - b. Explain the importance of dividing a building into zones for better control and optimization of energy and comfort.

- c. Defend why it is important to moderate building electrical use in some circumstances.
 - d. Describe how building automation can be used to reduce the electrical demand of buildings during peak demand periods using historical data.
- 6. Demonstrate an understanding of why electrical systems and their control systems are different for critical environments.
 - a. Characterize the types of facilities that have safety-critical electrical needs and require uninterrupted power.
 - b. Describe how a control system might be used to detect a need to trigger a redundant power source.
 - c. Describe how a control system can be used to smoothly switch from primary to backup power.
- 7. Demonstrate an understanding of the types of lighting that are used in different types of buildings.
 - a. Describe common types of lamp types (incandescent, gas discharge, halogen, fluorescent, low/high pressure sodium HID, LED) and the advantages and disadvantages of each.
 - b. Choose the best lamp type for given scenarios based on luminous efficacy ratings and other application considerations.
 - c. Identify and explain the purpose of the following components of a lighting system: electrical wiring, lamps, ballast, switches, dimmers, lighting contactor, light level and occupancy sensors.
 - d. Calculate the illuminance (in foot-candles and lux) of a surface based on the light source.
- 8. Demonstrate an understanding of the types of lighting control strategies that are used in different types of buildings.
 - a. Categorize types of building occupancy sensors (passive infrared, ultrasonic, microwave, dual-technology).
 - b. Describe how various light level sensors (photoresistor, phototransistor) work.
 - c. Distinguish the types of light dimmers by their function including autotransformer, phase control, dimming ballasts.
 - d. Interpret symbols and schematics for a lighting system.
 - e. Draw a schematic of an open-loop and a closed-loop lighting system.
 - f. Describe how a control system can be used to “harvest daylight” by adjusting lighting based on light-sensor readings.
 - g. Analyze how multiple lamps can be used to adjust lighting level without a dimming system.
- 9. Demonstrate an understanding of why lighting systems and their control systems are different for critical environments.
 - a. Characterize the types of facilities that have safety-critical electrical needs and require uninterrupted power.
 - b. Describe how a control system might be used to detect a need to trigger a redundant light source.
 - c. Describe different control strategies for ensuring safe lighting for critical environments.

Learning Units

- I. Electrical Power Generation Facilities
- II. Power Distribution Systems
- III. Secondary or Redundant Power Sources
- IV. Building Electrical Distribution System
- V. Monitoring Electrical Systems
- VI. Electricity and Critical Environments
- VII. Lighting Devices
- VIII. Lighting Control

IX. Lighting and Critical Environments

Method of Delivery/Instruction

☒ Face-to-Face

☒

Blended

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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.