

Bergen Community College
Division of Mathematics, Science and Technology
Department of Industrial Design Technology
Course Syllabus
Electric Power Technology - ELC 110

Semester and year:

Course Number: **ELC 110**

Meeting Times and Locations:

Instructor:

Office Location:

Phone:

Office Hours:

Email Address:

COURSE DESCRIPTION: Electric Power Technology covers the basics of power systems for residential, commercial, and industrial applications from a practical viewpoint.

CREDITS/HOURS: 4 credits 3 hr. lecture; 3 hr. lab

PREREQUISITES AND CO-REQUISITES: None

GENERAL EDUCATION COURSE: No

COURSE OBJECTIVES:

This course introduces the fundamental concepts of and computations related to DC/AC electricity. Emphasis is placed on DC/AC circuits, components, operation of test equipment; and other related topics. Students will be able to construct, verify, troubleshoot, and repair DC/AC circuits.

This course also covers layout, planning, and installation of wiring systems in industrial facilities. Emphasis is on residential commercial and industrial wiring methods and materials. Upon completion, students will be able to install electrical systems and equipment.

Additionally the course introduces the care and use of tools and materials used in electrical installations as well as the requirements of the National Electrical Code. Topics include electrical safety and electrical blueprint reading; planning, layout, and installation of electrical distribution equipment; lighting; overcurrent protection; conductors; branch circuits; and conduits. Upon completion, students should be able to properly install conduits, wiring, and electrical distribution equipment associated with basic electrical installations.

STUDENT LEARNING OBJECTIVES & ASSESSMENT MEASURES:

Knowledge and understanding

1. Understand basic electrical theory.
2. Demonstrate general safe work practices in electrical installations
3. Demonstrate electrical safety while working on equipment
4. Interpret the National Electrical Code as it applies to wiring of electrical equipment
5. Interpret, create, and modify ladder and wiring diagrams.
6. Develop, design, install, test and troubleshoot control circuits from basic through advanced.
7. Demonstrate the ability to identify, select and install the correct electrical devices
8. Recognize electrical control devices in an industrial application.

Skills and abilities

1. Have hands on design skills, replicating those required in actual commercial service. This will be taught and used by the student in realistic (lab) setting.
2. At the discretion of the instructor, assessment measures may be somewhat modified.

TEXTBOOK: Glen A. Mazur, Peter A. Zurlis, Electrical principles and Practices, Latest Edition American Technical Publishers, Homewood, Illinois, Inc; 2007, ISBN #

COURSE CONTENT (Lecture):

(A) Safety

- Describe the workplace safety programs and safety procedures relating to the electrician trade.
- Identify and describe the safe use of common hand tools and equipment related to the electrician trade.
- Identify and describe the safe use of common power and specialty tools related to the electrician trade.
- Identify and describe lockout procedures.
- Describe the methods of verifying and securing circuit isolation
- Describe precautions to be taken and procedures to be followed to prevent electric shock.
 - (a) Identify hazards arising from the use of electrical equipment
 - (b) Apply general safety rules in respect of checking of cables, leads and plugs, grounding and use of portable equipment and reduced voltage equipment
- State the requirements for the correct use of circuit identification, notices and labeling.
- List the general rules for observance of safe practices including
 - (a) Being alert
 - (b) Protecting oneself and other people
 - (c) Knowing emergency and site evacuation procedures to cover:
 - (i) Fire
 - (ii) Explosion
 - (iii) Toxic atmosphere
 - (iv) Security alerts
 - (d) Reporting all hazards and notifying appropriate authority
- OSHA Regulations

(B) Math principles and Applications

Calculate the power components of three phase systems

Calculate the three phase power components in a balanced three phase system.

Calculate the three phase power components in an unbalanced three phase system.

Use Kirchhoff's law to solve basic 3-wire distribution circuits.

(C) Basic Electrical Quantities

Define various electrical terms.

Describe and analyze series and parallel resistive circuits.

- Fundamentals of Alternating Current describe the fundamental characteristics of ac circuits.
- Explain the generation of an ac sine wave.
- Determine the output frequency of an ac generator.
- Calculate standard ac sine wave values.
- List the factors affecting impedance in an ac circuit.
- Electrical Theory Review Describe and analyze basic resistive electrical circuits

(D) Meter abbreviations and Displays

Explain the requirements for the installation of the equipment required for energy measurement.

- Describe the connection of self-contained meter sockets for electrical energy meters.
- Explain how to read energy and demand meters.
- Describe the connection and use of instrument transformers.
- Describe the connection of voltmeter and ammeter transfer switches.

(E) Taking Standard Measurements

- Describe proper use, care and safety precautions for various electrical meters.
- State the applications of the various meters.
- List the precautions that must be observed when using meters.
- Interpret the readings of analog meters.
- Interpret the readings of digital meters.
- Recognize the connections for various meters.
- Demonstrate proper range selection and connections of voltmeter, ammeter, ohmmeter and megger

(F) Abbreviations Acronyms and Symbols

- Understand and identify and read block diagrams, wiring diagrams and schematic drawings.
- Distinguish between a block diagram and a wiring diagram.
- Read and interpret electrical schematic drawings.
- Identify symbols that are commonly used in electrical drawings.
- Interpret terms used in electrical drawings.
- Interpret one-line diagrams.
- Interpret schematic diagrams.
- Describe the sequence of operation using a schematic diagram.
- Acquire a working knowledge of specifications.
- State the purpose of specifications.
- Describe the organization of specifications.
- Extract specific information from specifications.

(G) Circuit Conductors Connections and Protection

- Characteristics of Conductors
- Demonstrate the math skills required to calculate the resistance of a conductor of specific dimensions.
- Describe the factors affecting resistance.
- Calculate the resistance of a conductor of specific dimensions.
- Describe the electrical properties of materials.
- Describe fiber optic systems.

(H) Magnetism Solenoids and Transformers

- Describe electromagnetism and basic design considerations for electromagnetic devices.
Describe how an induced voltage is generated.
- Describe the process of electromagnetic induction.
- Describe the voltage and current characteristics of an ac and a dc generator.
- Describe the basic construction of a generator.
- Describe the basic construction and operating features of single phase transformers.
- List the basic features and describe the construction of a single phase transformer.
- List transformer cooling methods and describe PCB hazards.

- Analyze and connect multiple-winding transformers using their ratings and polarities.
- Calculate the ratings, ratios and associated values of a single phase transformer.
- State how transformer voltage taps are used.
- Describe transformer polarities.
- Connect a multiple winding transformer.
- Describe a Class 2 transformer.
- Connect and analyze single phase transformers used in parallel operation.
- Describe the operation of autotransformers.

(I) Electric Motors

- Describe the characteristics of an induction motor as it starts and runs, and as load is applied to the shaft.
- Three Phase Induction Motors
- Describe the theory of operation of an induction motor and perform connections of three phase induction motors.
- Identify terms related to a three phase induction motor and state the principle of operation of a squirrel cage induction motor.
- Describe the principle of operation of a wound-rotor induction motor.
- Describe the information located on a motor nameplate.
- Describe the types of single-speed three phase motors and controllers.
- Describe the types of multi-speed three phase motors and controllers.
- Connect and identify the leads on a nine lead motor.
- Connect and demonstrate the operation of the following three phase motor controllers
- Calculate the synchronous speed and percent slip of a motor.
- Determine the effect that the percent slip has on rotor parameters.
- Describe the relationship between torque and rotor electrical characteristics in a squirrel-cage induction motor.
- Determine a motor's breakdown torque.
- Calculate motor efficiency, speed regulation and horsepower.
- Explain the basic operation of a phase converter.
- Explain rotary phase converter operation
- Explain static phase converter operation.

(J) Residential Commercial and Industrial Circuits

- Installation of Electrical Equipment
- Describe the procedures for selecting receptacles and designing branch circuits for a residential occupancy
- Determine the branch circuit requirements, number and location of receptacles required for areas (other than kitchens) of a residential occupancy in general and specifically, a single dwelling.
- Describe the types of areas that require GFCIs and AFCIs and explain the operation of a GFCI and an AFCI.
- Determine the branch circuits required, the number and type of receptacles required and the location of each for a kitchen.
- Define and describe appropriate wiring methods for common installations.
- Define specific terms from Section 12 that apply to a residential occupancy.
- Demonstrate an understanding of the General Requirements sub-section in Section 12.
- Demonstrate an understanding of the Conductors, General, sub-section in Section 12.
- Describe the conditions for use of exposed wiring located outdoors.
- Describe the conditions for use of non-metallic sheathed cable.
- Describe the conditions for use of armoured and mineral-insulated cable.
- Describe the conditions for use of raceways in general.
- Describe the conditions for use of specific raceways.
- Describe the installation of boxes, cabinets and outlets.
- Determine the loading on services, feeders and branch circuits for single dwellings. Service Feeders and Branch Circuits
- Define specific terms from Section 8 that apply to a residential occupancy.
- Determine the minimum ampacity of service or feeder conductors supplying a single dwelling.
- Determine the minimum required number of branch circuit positions for a single dwelling.
- Determine the ampacity requirements for branch circuit conductors and ampere ratings of overcurrent devices applicable to a single dwelling.

(K) Introduction to the National Electrical Code

National Electrical Code (NEC). Topics include the NEC history, wiring methods, overcurrent protection, materials, and other related topics. Upon completion, students should be able to effectively use the NEC.

(L) Electric Control Devices

- Analog controls
- Solid state controls
- Digital controls

COURSE CONTENT (Laboratory):

1. Safety
2. Hands on design skills, replicating those required in actual commercial service, will be taught and used by the student in realistic (lab) setting.
3. Hands on use of various tools will be offered utilizing recommended safety products and procedures.
4. Representative installations will be visited, discussed, and analyzed. NABCEP test orientation and introductory preparation will be provided.

SUPPLEMENTARY READINGS / MATERIALS:

1. Theodore Wildi, Electrical Machines Drives and power Systems , prentice Hall Second Edition ISBN 0-13-251547-4
2. National Electrical code (NEC) handbook 2008, NFPA70, National Fire Protection Association, 1 Battery Park, Quincy, MA 02269.

OTHER REQUIREMENTS:

A scientific calculator is required. Cell phones cannot be used for calculations. Safety glasses or goggles must be purchased by the student.

GENERAL GRADING POLICY:

<u>GRADING SCHEME:</u>	A	90% - 100%
	B+	87% - 89.9%
	B	80% - 86.9%
	C+	77% - 79.9%
	C	70% - 76.9%
	D	65% - 69.9%
	F	0% - 64.9%

INSTRUCTOR’S GRADING POLICY:

Will be provided separately by the individual instructor.

ATTENDANCE/LATENESS POLICY:

All students are expected to attend punctually every scheduled meeting of each course in which they are registered. If a student is absent, s/he is responsible for learning the material covered, including homework assignments and any handouts. Small study groups to review lecture and homework material are usually found to be helpful. Attendance and lateness policies and sanctions are to be determined by the instructor for each section of each course. These will be established in writing on the individual course outline. Attendance will be kept by the instructor for administrative and counseling purposes.

OTHER POLICIES:

Electronic Devices: The use of portable electronic devices such as pagers and cell phones is not permitted while class is in session. Please silence these devices before entering class.

STUDENT AND FACULTY SUPPORT SERVICES:

1. Students experiencing difficulty with the arithmetic or problem solving aspects of this course should acquaint themselves with the services of the Tutoring Center and Smarthinking.
2. The BCC Library provides extensive support services for student research.
3. Faculty office hours may be a productive vehicle for assistance in understanding the course material.
4. A wide variety of services are available to students with documented disabilities through the Office of Specialized Services (OSS). It is highly recommended that students with documented disabilities contact OSS (Room S-131; 201-612-5270) during the college application process.

FACULTY ABSENCE PROCEDURE:

A daily listing of cancelled classes will appear in a glass case near the student center on the first floor. Another such listing will appear in a glass case in Ender Hall. Students can consult these cases before going to class. If students find a class cancelled which has not been listed, they should report this to the Divisional Dean's Office, A 325, or the Evening Office L113.

All BCC students enrolled in credit courses are entitled to a WebAdvisor account. With WebAdvisor, you may register online, pay your bill, check your schedule, room assignments, GPA, and find out what courses you need to take. To find out more about WebAdvisor or to sign up online, visit <http://go.bergen.edu>! While there, please make sure you give us your preferred email address. You'll find directions how to do this at <http://go.bergen.edu/email>.