

**1700039**

## **Advanced Electrical Systems**

### **COURSE INFORMATION**

Credits: 3.00

### **PREREQUISITES AND/OR COREQUISITES**

**Prerequisite:**

A minimum grade of C in 7900001 Electrical Systems or ELT 139

### **COURSE DESCRIPTION**

This class stresses electrical distribution systems, electrical transformers, AC and DC motor theory, operation and repair, motor testing and sizing procedures, manual and magnetic starters, and motor overload protection. Specific topics will include types of electrical distribution systems, transformer theory and operation, electrical safety related to motor systems, lockout/ tagout techniques, use of motor testing devices, and construction, sizing, and installation of motor overload devices. Extensive laboratory exercises will enhance classroom studies.

### **COURSE GOALS**

- I. Describe residential, commercial, and industrial distribution systems and demonstrate techniques for electrical system grounding and ground fault interrupters.
- II. Describe the construction, operation, and installation of typical electrical transformers.
- III. Explain the operation and mechanical considerations associated with DC motors.
- IV. Explain the major AC motor classifications, give examples of applications for each type, and specify pertinent motor selection criteria.
- V. Demonstrate the applications of magnetic starters.
- VI. Specify the correct size and type of overload device for a particular installation.
- VII. Demonstrate component and circuit troubleshooting methods.

### **STUDENT LEARNING OUTCOMES**

- I. Electrical Distribution Systems
  - A. Describe primary distribution systems, residential, commercial, and industrial distribution systems
  - B. Explain and demonstrate techniques for electrical system grounding and ground default interrupters.
  - C. Interpret electrical diagrams of in-plant distribution systems.
- II. Transformer Theory and Configurations
  - A. Describe the magnetic theory by which all transformers operate.
  - B. Describe the construction and operation of different types of electrical transformers.
  - C. Connect both control and power system transformers.

- III. DC Generators and Motors
  - A. List the component parts of a DC Generator, and state their functions and interaction concepts.
  - B. Describe the operation of a typical DC generator with respect to mechanical considerations, voltage output, and generator losses.
  - C. Recognize, draw and describe typical voltage/current/efficiency curve for the following DC generator types: series, shunt, separately excited, and compound.
  - D. State the operation and mechanical considerations associated with DC Motors.
  - E. List the principles and applications for following DC motor types: series, shunt, PM and compound.
  - F. Demonstrate the maintenance skills necessary to perform the following tasks: brush inspection and replacement, bearing inspection, field and armature conductor testing, and motor installation and wiring.
- IV. AC Motors
  - A. List the major AC motor classifications, give examples of applications for each type, and specify pertinent motor selection criteria.
  - B. Perform the calculations required to predict slip percentages, synchronous field speed, rotor speed, torque, and loading effects.
  - C. Regarding the function of single-phase motors the student will explain the principle of phase-splitting, capacitor start/run, repulsion/induction, shaded-pole, and universal motors.
  - D. Given a typical motor nameplate, the student will describe the data listed thereon.
- V. Manual and Magnetic Starters and Overloads
  - A. Explain the construction and operating principles of starters relating to the magnet coil, power contacts, auxiliary contacts, and shading polls.
  - B. Explain the principles of magnetic starters relating to the magnet coil, main contacts, auxiliary contacts, and shaded poles.
  - C. Give usage examples of both toggle style and pushbutton style manual starting systems.
  - D. Explain the purpose of motor overload protection system device, list the primary types of over load devices, and define the operational characteristics of each particular type.
- VI. Electrical troubleshooting
  - A. Demonstrate the use of voltmeters, ammeters, ohmmeters, and megohmmeters in troubleshooting.
  - B. Demonstrate knowledge of individual component operation to be able to troubleshoot component.
  - C. Use meters to troubleshoot a non-functioning circuit.
  - D. Describe safety procedures for a conducting live-circuit troubleshooting.

## **COURSE MATERIALS**

Industrial Electricity, Michael E. Brumbach, 9th edition, 2017, Cengage learning ISBN# 978-1-285-86398-6

## **GRADING CRITERIA**

Students can expect to be graded on Written Assignments, Quizzes, Tests, Lab Activities, and Attendance. There is currently no scheduled time available to makeup classes or labs that are missed.

## **PARTICIPATION/ATTENDANCE POLICY**

Students can expect that attendance/participation will be a part of their final grade, and determined by the instructor at his/her discretion. Students are encouraged to attend every class as regular attendance as it contributes to successful course completion and will impact the final grade.

## **COURSE EXPECTATIONS**

For successful completion of this course, students are expected to Read Course Material, Complete all Assignments, Take Notes, Study and Participate in classroom discussions.

## **ACADEMIC INTEGRITY AND CONDUCT POLICY**

The integrity of a class and program rests on the principle that the grades awarded to students must reflect only their own individual efforts and achievement. Students are required to perform the work specified by the instructor and are responsible for the content of work submitted, such as papers, reports, examinations, and other work. Violations of academic integrity include various types of plagiarism and cheating.

### ***\*Plagiarism\****

\*Plagiarism includes, but is not limited to:

- Using exact words from a source without appropriate crediting
- Cutting and pasting electronically from any source without appropriate crediting
- Using wording and/or sentence structure too close to the original in paraphrasing
- Using visual images in whole or in part created by someone else without appropriate crediting
- Buying a paper and presenting any part of it as your own
- Borrowing any part of a paper and presenting it as your own without appropriate crediting
- Falsifying or inventing any information or citation in an academic exercise

### ***\*Cheating\****

\*Cheating includes, but is not limited to:

- Obtaining or giving assistance in any academic work such as on quizzes, tests, homework, etc., without instructor's consent
- Taking a test or course or turning in work for someone else
- Allowing someone to take a test or course or turn in work in your name
- Using crib notes or electronic devices to get unauthorized assistance on tests or other in-class work

- Using work from another class or previous semester without instructor consent

## **CLASS CANCELLATION POLICY**

Class meetings can occasionally be called off due to bad weather, check the local news and radio for information or call 319-296-4444 for the current status of college closings, class cancelations, delay start, or early dismissal information.

## **STUDENTS' SPECIAL NEEDS STATEMENT**

Hawkeye Community College (HCC) strives for student-centered, quality education with flexibility to allow for students' special needs. Students with physical, mental, or learning disabilities should contact the Special Needs Coordinator in Student Services at 319-296-4014 or [specialneeds@hawkeyecollege.edu](mailto:specialneeds@hawkeyecollege.edu) to learn how to apply for accommodations at HCC. Or, visit our website for more information and forms: <http://www.hawkeyecollege.edu/students/services/student-disability-services/default.aspx>

## **NONDISCRIMINATION STATEMENT**

Hawkeye Community College does not discriminate on the basis of sex; race; age; color; creed; national origin; religion; disability; sexual orientation; gender identity; genetic information; political affiliation; or actual or potential parental, family, or marital status in its programs, activities, or employment practices as required by Iowa Code §§ 216.6 and 216.9, Titles VI and VII of the Civil Rights Act of 1964 (42 U.S.C. §§ 2000d and 2000e), the Equal Pay Act of 1973 (29 U.S.C. § 206, et seq.), Title IX (Educational Amendments, 20 U.S.C. §§ 1681-1688), Section 504 (Rehabilitation Act of 1973, 29 U.S.C. § 794), and Title II of the Americans with Disabilities Act (42 U.S.C. § 12101, et seq.). Veteran status is also included to the extent covered by law. Any person alleging a violation of equity regulations shall have the right to file a formal complaint. Inquiries concerning application of this statement should be addressed to: John Clopton (Equity Coordinator and Title IX Coordinator for Employees) or Nancy Henderson (Title IX Coordinator for Students), Hawkeye Community College, 1501 East Orange Road, P.O. Box 8015, Waterloo, Iowa 50704-8015, telephone 319-296-4405, email: [equity-titleIX@hawkeyecollege.edu](mailto:equity-titleIX@hawkeyecollege.edu), or the Director of the Office for Civil Rights, U.S. Department of Education, Citigroup Center, 500 W. Madison, Suite 1475, Chicago, IL 60661, phone number 312/730-1560, fax 312/730-1576.

## **DISCLAIMER**

This syllabus is believed to be accurate at the time it was written. However, the instructor reserves the right to make changes as deemed necessary, provided notification is given to the students.

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