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Iowa Lakes Community College is committed to ensuring that all programs and services, including electronic and our website (www.iowalakes.edu), are accessible to people with disabilities. In accordance with the provisions of Sections 504 and 508 of the Rehabilitation Act and the Americans with Disabilities Act (ADA), Iowa Lakes provides students, faculty, staff, and visitors with reasonable accommodations to ensure equal access to the programs and activities of the college. For more information visit: <https://www.iowalakes.edu/educational-counseling-services/accommodations-disability-resources>.

Doug Zemler is Electrical Technology Program Coordinator at Iowa Lakes Community College.

Updated in 2017, this course covers an introduction to power generation and transmission offered in credit programs in a face-to-face format.

Course Syllabus

Power Generation & Transmission / WTT-216 **Monday 2-4 pm Lecture** **Thursday 10-12 am, 2-4 pm Laboratory** **Fall / 2017**

Iowa Lakes Community College
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Estherville, IA 51334

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Office Hours: As posted on office door

Catalog Description: WTT-216-100 Power Generation & Transmission will serve as an introduction to the generation of electrical power with a wind turbine generator, moving that power through a local transmission system to a substation where a customer will purchase the generated power. This course will cover all aspects of working with components of a high voltage transmission system.

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Prerequisites: DC Electrical Theory, AC Electrical Theory, Electric Motors & Generators

Credits: Lecture credits 2, Laboratory credits 1

Text & Additional Materials:

1. Electrical Essentials for Power Line Workers 2nd Edition, by Wayne Van Soelen.
2. Experiments in Electricity 3RD Edition (lab book), by Stephan Herman
3. 101 Basic Series of online training at www.eaton.com/learning .
4. Introduction to the NFPA 70 and 70E
5. OSHA CFR 1910.269 and 1910.331- .335

Course Objectives: Students will become familiar with three phase power systems and how they are utilized in wind turbine electrical power generation. Students will understand the two major variations of three phase power (Delta & “Y”). Students will become familiar with the NFPA 70E, NEC, NESC, transformers, relays, capacitors, fuses, circuit breakers, voltage regulators, switchgear, batteries and other equipment that is used to move electrical power as part of an electrical power transmission system. Students will also understand the function of a substation and related components as used to transmit power generated from wind turbine generation facilities.

Competencies:

1. Discuss NFPA 70E Arc Flash Hazard Analysis/ rubber gloves
2. Identify the advantages of three phase electrical power
3. Define three phase Delta connections, voltages, currents and power
4. Define three phase Wye connections, voltages, currents and power
5. Identify types of power transformers
6. Review transformer construction
7. Review the primary windings and secondary windings of a transformer
8. Review the term “Turns Ratio” and how it applies to power transformers
9. Explain safety practices used when working with or around power transformers
10. Identify applications of transformers
11. Explain how to perform a polarity test of a power transformer
12. Identify transformer taps and tap changers
13. Identify transformer connections
14. Define power quality and correction techniques
15. Explain how protective relays are used in electrical power transmission

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16. Define the purpose of a substation
17. Discuss the use and purpose of installing temporary grounds
18. Define the use and purpose of batteries in high voltage systems
19. Identify components of a typical substation and their purpose
20. Define safe operation of high voltage components
21. Identify proper protocol when switching high voltage components
22. Discuss switch gear construction
23. Discuss types of high voltage circuit breakers
24. Explain the different types circuit protection on a high voltage system
25. Explain operation of high voltage fuses
26. Discuss the procedures for working in the electrical environment
27. Identify the different types of power cable in industry
28. Use a multi-meter
29. Use a Megger meter for insulation testing and earth resistance testing
30. Use a Megger DLRO10HD low resistance ohmmeter
31. Read and identify symbols, prints, schematics, and one line diagrams
32. Discuss smart grid technology that pertains to the wind industry
33. Work and do labs for substation

Course Schedule/Outline (Units of Instruction):

1. Review the NFPA 70E Arc Flash/Circuit Analysis/use of rubber gloves
2. Review Selective Coordination
3. Review Current Limitation Applications
4. Review three phase power systems
5. Introduction to transformers
6. Transformer applications
7. Transformer protection
8. Various transformer types
9. How to use hot sticks
10. Review Temporary Grounds
11. Electrical power transmission
12. Substations
13. Batteries
14. Conductors and conductor properties
15. High voltage components/breakers/circuit protection
16. High voltage safety and switching protocol
17. Use of multi-meters and practical use

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18. Use of Megger meter for insulation testing and resistance testing
19. Use of Megger DLRO digital low resistance ohmmeter
20. Field trips to various locations to see high voltage equipment in use
21. Study smart grid technology
22. Work in substation
23. Modules 4,5,6,7,8,10,11,27,28,29 from Eaton 101 Basic Series online learning.

Methods of Instruction: Course will consist of two hours of lecture period, once each week, which may include covering text book assignments, discussion, demonstrations and other methods to be determined by the instructor. Two hours of lab that will cover material discussed over lecture. Lab will consist of programming demonstrations and troubleshooting practice by the students as well as other methods determined by the instructor.

Grading Policies:

Scale: **A** = 90% to 100%
 B = 80% to 89%
 C = 70% to 79%
 D = 60% to 69%
 F = Less than 60%

Grading Policy: The instructor will determine the weight of each assessment towards overall points. Graded components are as follows:

Attendance
Assignments
Labs
Tests & Quizzes
Final Exam
Final Lab
Participation

Other Rules and Expectations: I believe that for learning to take place students must be actively involved. For this reason, I place emphasis on class attendance. Students are expected to attend all classes and labs. Attendance will be taken at the beginning of class. If you are late, you will not be given attendance credit for that day (remember, 10 percent of your grade is attendance). If you are late, enter the classroom quietly and do not disturb your fellow students. I give a ten-minute break during lectures. Use the restrooms at that time or get your drink. If you leave the classroom during lecture, you will be docked 10 points (other than emergency situations). If students are unable to attend classes, labs, or tests, the

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instructor is to be notified, by email or voice mail, before absence occurs. Three consecutive class absences require me to notify the main campus and they will get in touch with you. Habitual absences of three or more will go against your participation grade for the class (20 percent of your grade). Students who are excused by the instructor will be allowed to make up work and tests. If you miss a class, it is your responsibility to get copies of notes or assignments from a fellow student. If you miss an assignment, you have one week to complete assignment. After that one week, if the work has not been turned in, you will receive zero points for the assignment. Students who are absent and have not notified the instructor will receive a 20 percent deduction on tests and assignments. Extra credit will not be given in this class. Incompletes are only issued when a student can establish a completion date. If you need to leave class early, let the instructor know ahead of time and leave quietly. Students who wish to leave the room while the test is in progress must submit their exam as completed. Deadlines for turning in labs, lab books, assignments and tests is strictly enforced (no exceptions). You need to listen to your instructor when that deadline is and write it down (no excuses).

Cell phone use (including texting) is prohibited in lecture and labs. If you are caught using your phone (except for an emergency situation) you will be docked 10 points for the day. If you are expecting an emergency call, please let me know prior to class (birth, family illness, etc.).

Students may use a laptop computer to take notes during lecture, provided it does not cause a distraction. The instructor will not notify students individually if assignments or deadlines are missed. Students should utilize instructor office hours to determine missed assignments and grades. Students are responsible for learning the course material covered during their absence. Students are expected to conduct themselves in a professional manner. Any behavior which is disruptive or unsafe may be grounds for removal from class.

Foul, profane, or vulgar language will not be tolerated in the classroom or in the field and a student or students will be told to leave the class. No smoking or chewing tobacco is allowed on campus grounds. When you are working in your lab area, keep it clean and organized. That means that all test equipment will be put away neatly and properly in its proper cases. Keep your lab area swept and all garbage thrown away (pop cans, bottles, wire pieces, etc.). Make sure that all electrical power is shut off to test and lab equipment when finished. Wiring will be done in a neat and professional manner and wire reels put away. All safety grounds must be in place before testing. The instructor has the discretion in determining if the work station is clean and safe. Failure to follow these rules will cost you 25 percent off of your lab grade for that day. You will be using various voltage levels in lab. Extreme care must be observed when doing labs. The Meggers can create high voltages during testing procedures on equipment. Use of rubber gloves and safety glasses is REQUIRED. You will ground and discharge equipment when doing megger tests. When working in the substation, hard hats, safety shoes and safety glasses are required. Anyone not wearing safety glasses during lab will be asked to leave and will receive no credit for the lab. Anyone can

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shut the lab down if they observe a safety violation. STAY SAFE-friends are not all that easy to find in this life!

Important: NO food or drinks in the lab.

Students must abide by all policies as stated in the Iowa Lakes Community College Student Handbook.

Students should be aware that classes might be audio or video recorded by one or more students. The college's policies governing the audio or video recording of class are included in the Student Handbook. Students who have any questions or concerns about class recordings should address their questions or concerns with the instructor at the *beginning of the semester*.

STUDENT ACADEMIC HONESTY POLICY

Iowa Lakes Community College believes that personal integrity and academic honesty are fundamental to scholarship. Iowa Lakes strives to create an environment where the dignity of each person is recognized and an atmosphere of mutual trust exists between instructors and students. The faculty has confidence in the integrity of the students and encourages students to exercise good judgment in fulfilling this responsibility.

Actions contrary to academic integrity will not be tolerated. Activities that have the effect or intention of interfering with learning or fair evaluation of a student's work or performance are considered a breach of academic integrity. Examples of such unacceptable activities include, but are not limited to:

- **Cheating** (intentionally using or attempting to use unauthorized material, assistance or study aids in my academic work). For example, using a cheat sheet for a test, looking at another student's paper during an exam, stealing or buying all or parts of an exam or paper, altering and resubmitting work for a better grade without prior approval to do so, etc.
- **Plagiarism** (representing another's ideas, words, expressions or data in writing or presentation without giving proper credit, failing to cite a reference or failing to use proper documentation, using works of another gained over the Internet and submitted as one's own work).
- **Falsification and/or misrepresentation of data** (submitting contrived or made-up information in any academic exercise). For example, making up data, citing non-existent sources, etc.
- **Facilitating Academic Dishonesty** (knowingly helping or attempting to help another violate any provision of the academic honesty policy). For example, working together on a take-home exam or other assignment when the option has not been made available, giving a paper/assignment to another student for his/her use, etc.
- **Multiple Submissions** (submitting, without prior approval from the instructor involved, any work submitted to fulfill academic requirements in another class). For example, submitting the same paper for two different classes, etc.
- **Unfair Advantage** (trying to gain unauthorized advantage over fellow students). For example, gaining or facilitating unauthorized access to exam materials (past or present); interfering with another student's efforts in an academic exercise; lying about the need for an extension on a paper or assignment; destroying, hiding, removing or keeping library materials, etc.

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Disciplinary Action

Any violation of this policy will be treated as a serious matter. The instructor has primary responsibility over classroom behavior and maintaining academic integrity. Students who earn an "F" based on any violation of the Student Academic Honesty Policy may not withdraw from the class (and receive a grade of W). Depending on the nature and severity of the offense, Iowa Lakes Community College reserves the right to exercise disciplinary action as outlined in the Disciplinary Action Section of the Student Handbook.

Americans with Disabilities Act – Policy of Nondiscrimination

It is Iowa Lakes Community College policy to not discriminate against qualified individuals with disabilities and to provide reasonable accommodation(s), as required by law, to otherwise qualified applicants for admission or to students with disabilities in all education programs, activities, services and practices, including application procedures, admissions, course selection, the awarding of degrees, discipline and dismissal. Educational opportunities will not be denied to an otherwise qualified application or student because of the need to make reasonable accommodation(s) or modification(s) for the physical and mental impairment(s) of any such individual.

Iowa Lakes Community College students needing reasonable accommodation(s) and/or modification(s) should contact Jody Condon by phone at (712) 852-5219 or via email at jcondon@iowalakes.edu. To assure that accommodation(s) and/or modification(s) will be ready when classes start, students must make the request as soon as possible, before a semester begins.

It is the policy of Iowa Lakes Community College not to discriminate on the basis of sex, race, national origin, creed, age, marital status or disability in its education programs, activities, or employment policies, as required by Titles VI and VII of the 1964 Civil Rights Act, Title IX of the 1972 Educational Amendments, Section 504 of the Federal Rehabilitation Act of 1973 and Title II of the Americans with Disabilities Act (ADA) of 1990.

Inquiries regarding compliance with Title IX, Title VI, Title VII, or Section 504 may be directed to Kathy Muller, Human Resources, Iowa Lakes Community College, 19 S. Seventh Street, Estherville, IA 51334, telephone (712) 362-0433; to the Director of the Iowa Civil Rights Commission, Des Moines; or to the Director of the Region VII Office of Civil Rights, Department of Education, Kansas City, Missouri.

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