Instructor: Prof. Vigs Chandra, PhD
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E-mail: vigs.chandra@eku.edu
Web: http://people.eku.edu/chandrav

Class schedule: Section 001, CRN: 26075; MW: TBA, in Room 407/400
Office Hours: MTWR: 10 a.m. – 11:30 a.m., and 4:30 p.m. – 6 p.m. If my office door is open at other times I will most likely be available for discussion. Come right in. You may email me regarding additional meeting times if needed.

CATALOG COURSE DESCRIPTION:
Principles of electromagnetic induction as applied to the generation, distribution, conversion, control, and measurement of electrical power. Analysis of the electronics used for electrical drives controlling machinery and computer systems. Installation, programming and maintenance of digital drives are covered in a combination of lecture, demonstration, and laboratory.

Prerequisite:
EET251, EET257 and MAT108 or higher

TEXTS:
Required

Reference:

STUDENT LEARNING OUTCOMES:
Upon completion of this course, the student will:
1. Explain the principle of electromagnetic induction and its use in operation of DC, single-phase AC and three-phase AC electrical machinery.
2. Construct, test and troubleshoot common industrial and commercial control circuits utilized with electrical machinery.
3. Analyze and troubleshoot electronic circuits related to single-phase and three-phase AC to DC half-wave and full-wave rectifier circuits.
4. Analyze and troubleshoot DC to DC converter circuits (Choppers), DC to AC inverter circuits.
5. Control the speed of electrical motors using Pulse Width Modulation (PWM) control
6. Install, configure, operate, maintain, troubleshoot digital electronic drive systems
7. Maintain proper safety precautions while installing, operating, and troubleshooting electrical power and control equipment.
8. Communicate electrical power and control system procedures, testing/troubleshooting steps, and experimental results in writing.

COURSE OUTLINE:

1. AC/DC circuit review: DC/AC power, AC power factor, series/parallel circuits
2. Electrical safety
3. Electrical drawings
4. Functional block diagram of DC and AC electrical drives
5. Electromagnetic induction used for the generation of electrical power
6. DC Power conversion systems:
   a. Basic DC machine principles
   b. DC generators and motors - separately excited, series and shunt
   c. Pulse width modulation (PWM) for speed control of DC motors
7. Types of DC motor speed control: Field current and Armature voltage
8. Open and closed loop operation of Operational Amplifiers for controlling the speed of DC motors
9. DC Drive schematics and datasheets
10. Direction control and braking in electrical motors
11. Microcontroller based control of electrical motors
12. Fixed DC voltage to variable DC voltage conversion (choppers) to control the speed of DC motors
13. Adjustable-speed electrical drives
   a. Drive selection and troubleshooting
   b. Drive applications in computer systems, manufacturing industry and exploration
14. AC machines
   a. Inverters – DC to AC conversion
   b. AC power conversion systems:
      (i) AC Motor review
      (ii) AC single-phase and three-phase induction motors
   c. AC drives using:
      (i) Variable Voltage Inverters (VVI) and Current Source Inverters (CSI)
      (ii) Pulse Width Modulation (PWM)
EVALUATION METHODS:
Each student will be evaluated as follows:

- Assessments (35%) – mid-term and a final, including the final
- Laboratory activities (30%) – 10 (approx.)
- Design project and presentation (25%)
- Two-page paper (5%) – electrical safety for industrial electrical machinery
- Portfolio (5%) – organize course materials

Design project and presentation:
Design and build or simulate an electrical power technology application. Research articles in the area of DC/AC motor control, the application of drives (including computer systems) in industry as they relate to your project. Digital photos of the project are to be included with the report.

A demonstration of your work is required, along with detailed individually written project report, approximately 6-8 pages in length (excluding title page, references and appendices). Use appropriate bibliographical references, in American Psychological Association (APA) format ([http://nutsandbolts.washcoll.edu/apa.html](http://nutsandbolts.washcoll.edu/apa.html)). If online sources are used, the reference should also include a persistent link to the article when possible. Refer to the Academic Search Premier Database ([http://www.library.eku.edu/new/index.php](http://www.library.eku.edu/new/index.php)) which is made available through the EKU libraries, for identifying articles related to the topic. Refer to an online video tutorial on using the EKU library databases for retrieving articles (the EKU libraries website may have changed slightly, but the procedure for searching articles is likely to be similar to this): [http://www.people.eku.edu/chandrav/Ref/onlineArticlesEKU.wmv](http://www.people.eku.edu/chandrav/Ref/onlineArticlesEKU.wmv).

Course portfolio
Organize EET 452 course materials in the portfolio by maintaining separate sections for notes/worksheets, laboratory activities, paper, assessments, project drafts/final report, and reference materials including data sheets and handouts, etc.

Course Requirements:
Students are expected to:
1. Attend each lecture and laboratory session.
2. Complete all homework and reading assignments, simulation experiments and submit these on the prescribed dates.
3. Complete assigned laboratory work and project work as prescribed by the instructor.
4. Complete the assessments covering material from: homework, labs, and from assigned readings in the text.
5. Maintain a 3-ring binder or folder for organizing class and reference materials

Grades:

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<tr>
<th>Percentage</th>
<th>Grade</th>
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<tbody>
<tr>
<td>100-90%</td>
<td>A</td>
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<td>89.9-80%</td>
<td>B</td>
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<td>79.9-70%</td>
<td>C</td>
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<tr>
<td>69.9-60%</td>
<td>D</td>
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<tr>
<td>Below 60%</td>
<td>F</td>
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Mid-term grades will be made available to students by Friday, March 5, 2010.

Tuesday, May 11, 2010 – Final grades available online under EKUDirect/StudentRecords/Official Grade Report
STUDENT PROGRESS:
Students will be informed of their progress in the course after the 1\textsuperscript{st} assessment (approximately 6\textsuperscript{th} week of the semester). All students are encouraged to meet with me for discussing their progress as well as to identify opportunities for improvement at any time during the semester.

Friday, March 19, 2010 – Last day to withdraw with a "W" from a full-semester class, or to withdraw from full-semester classes or withdraw from the university.

OFFICIAL E-MAIL:
An official EKU e-mail is established for each registered student, each faculty member, and each staff member. All university communications sent via e-mail will be sent to this EKU e-mail address.

ATTENDANCE POLICY:
Regular attendance is needed for students in order to successfully complete the course. After the second (2), unexcused absence each unexcused absence will cause a five percent (5\%) deduction in the overall percentage. Five (5) to seven (7) unexcused absences will result in one letter grade lower each. Your grade will be an automatic F if you have more than seven (7) unexcused absences. If you have a university accepted excused absence, make-up work is permitted with no penalty. Makeup labs/exams will be permitted only if you had sought and received my approval prior to the absence which caused you to miss the related lab/exam. You will benefit most by way of understanding the content of the course by completing all the assigned work in a timely manner. If you know in advance that you will be absent, please inform me at the earliest. Email is usually the fastest way of contacting me.

Cell Phones: Cellular phones should be off or on silent operation during class in order to keep classroom distractions at a minimum. Under special circumstances students are permitted to use the phone but should seek my approval prior to class.

DISABILITY STATEMENT:
If you are registered with the Office of Services for Individuals with Disabilities, please obtain your accommodation letters from the OSID and present them to the course instructor to discuss any academic accommodations you need. If you believe you need accommodation and are not registered with the OSID, please contact the Office in the Student Services Building Room 361 by email at disserv@eku.edu or by telephone at (859) 622-2933 V/TDD. Upon individual request, this syllabus can be made available in an alternative format.

ACADEMIC INTEGRITY STATEMENT:
Students are advised that EKU’s Academic Integrity policy will strictly be enforced in this course. The Academic Integrity policy is available at www.academicintegrity.eku.edu. Questions regarding the policy may be directed to the Office of Academic Integrity.

омните The work you do in the laboratory, and the grade you earn, should reflect your personal abilities, and accomplishments. Individual lab reports are required from each student. I encourage you to discuss class assignments with others. However any work you submit must be your own.

Any suggestions leading to improvements in the content or presentation of the course, especially in the laboratory work, are most welcome.