

EET 452
Electrical Power & Drives
Spring 2007

Instructor:

Prof. Vigs Chandra, PhD

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Office:

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Class schedule:

Section: 001, CRN: 23070; TR: 8 - 9.55 am, in Room 407/400

Office Hours:

MW: 8 - 10 am, MTWR: 4.30 pm - 6 pm. If my office door is open at other times I will most likely be available for discussion. Come right in.

Credit hours:

3

Prerequisite:

EET251, EET257 and MAT108 or higher

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.

TEXTBOOK:

Electronic Variable Speed Drives, 2nd / 3rd Edition. Author – Michael E. Brumbach; Delmar Thompson Learning; ISBN: 0766828395 / 140188962X.

Reference:

Electricity and electronics: A Survey, 5th Edition; Dale Patrick & Stephen Fardo, Prentice Hall publishers; ISBN: 0130195642

COURSE OBJECTIVES:

Through structured content discussions in the classroom and simulation/ experimental work in the laboratory, the following course objective should be realized:

1. Understand the principle of electromagnetic induction and its use in operation of DC, single-phase AC and three-phase AC generators and motors.
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. Familiarization with and understanding of the operation of DC/AC drives.
5. Analyze and troubleshoot DC to DC converter circuits (Choppers), DC to AC inverter circuits.
6. Pulse Width Modulation for the speed control of electrical drives.
7. Install, maintain and troubleshoot digital electronic drive systems
8. Programming digital electronic drive control systems.

COURSE OUTLINE:

1. AC/DC circuit review: DC power, AC power, AC power factor
2. Electromagnetic induction used for the generation of electrical power
3. 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
4. Types of DC motor speed control: Field current and Armature voltage
5. Open and closed loop operation of Operational Amplifiers for controlling the speed of DC motors
6. DC Drive schematics and datasheets
7. Direction control and braking in motors
8. Fixed DC voltage to variable DC voltage conversion (choppers) to control the speed of DC motors
9. Inverters – DC to AC conversion

10. AC power conversion systems:
 - A. AC Motor review
 - B. AC single-phase and three-phase induction motors

11. AC drives using:
 - A. Variable Voltage Inverters (VVI) and Current Source Inverters (CSI)
 - B. Pulse Width Modulation (PWM)

12. Drive selection and troubleshooting

13. Drive applications in computer systems, manufacturing industry and exploration

COURSE REQUIREMENTS:

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 materials.

Attendance Policy:

After the second unexcused absence, each unexcused absence will cause two percent deduction from the overall percentage. Four (4) 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. 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 assignments in a timely manner. If you know in advance that you will be absent, please inform me at the earliest.

EVALUATION:

Each student will be evaluated as follows:

- Assessments (45%) – 3
- Laboratory (30%) – 10 (approx.)
- Design project and presentation (15%)
- Two-page papers (10%) – write-up on topics related to electric power and drives

You may rework and resubmit your assessments (except the final), papers or labs for limited partial credit. Papers and labs turned in late will have reduced credit.

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. You may choose to work by yourself or in groups of up to three persons. A demonstration of your work is required, along with detailed project report, approximately 7-10 pages in length (excluding title page and appendices), along with appropriate bibliographical references [in American Psychological Association (APA) format (<http://nutsandbolts.washcoll.edu/apa.html>)].

The project report should contain a title page; a one paragraph summary or abstract about your project; an introduction/background section with motivation for the project, and the relevant theory on which it is based; a section on the issue you are trying to solve; a section on your suggested design solution including illustrations and circuit diagrams; a results section summarizing your observations and any troubleshooting which were needed; conclusions emphasizing the significance of the project, and ideas about how the project can be extended further; a section listing at least 3 references in APA format; and finally appendices including any programs, manufacturer specs., etc.

Two-page Papers:

Two paper related to electrical power technology are required, each of length at least 2 pages. The 1st paper must be on the topic of electrical safety; 2nd on some aspect of DC/AC motor control. Topics for the 2nd paper include but are not limited to: practical applications of drives, power control using semiconductors, computer drive systems, industrial drive controllers, ongoing advancements in electrical power control, etc. Summarize in your own words, the main points of the articles, what you found most interesting and informative, and indicate how the article relates to class discussions or lab activities. All references should be formatted using APA guidelines. For identifying sources of technical articles, refer to the online ECU library databases and a tutorial video http://www.people.ecu.edu/chandrav/Ref/online_search_ECU_libraries.wmv.

Grades:

100-90%	= A	69.9-60%	= D
89.9-80%	= B	Below 60%	= F
79.9-70%	= C		

Mid-term grades will be made available to students before Sat., March 10, 2007.

Student in the College of Business & Technology (CBT), including CEN/CE majors enrolled in EET452 are required to register for and attend the CBT Professional Skills Conference, Friday, April 6, 2007. While registering juniors should select BTS 300-001, CRN# 28888, and seniors should select BTS 400-001, CRN# 28895.

STATEMENT OF DISABILITY:

ADA

If you are registered with the Office of Services for Individuals with Disabilities, please make an appointment with the course instructor to discuss any academic accommodations you need. If you need academic accommodations and are not registered with the Office of Services for Individuals with Disabilities, please contact the office on the third floor of the Student Services Building, by email at disabilities@ecu.edu or by telephone at (859) 622-2933 V/TDD. Upon individual request, this syllabus can be made available in alternative forms.

☺ The work you do in the laboratory, and the grade you earn, should reflect your personal abilities, and accomplishments. Individual homework and lab reports are required from each student. I encourage you to discuss your assignments with other students. 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.