Electrical Engineering 362: Electromechanical Energy Conversion

Course Description: 3 cr. U. Principles of electrical and electromechanical energy conversion; three-phase circuits, transformers, three-phase induction and synchronous machines, d.c. machines, including design parameters and testing; with laboratory (3 hr lc recitation & 2 hr la per week). Prereq: eleceng 361(p).

Textbook: Electric Machinery, A. E. Fitzgerald et al., McGraw-Hill, 7th Edition. If you can obtain a 6th edition used or by some other means that should be sufficient. It will be virtually impossible to do well in the class without this text book. The text is available in the bookstore. The ISBN number is 10: 0073380466.

Prerequisites by Topics:
- Three phase power system analysis
- Phasor math
- Concepts of electrical conductivity and resistivity
- Concepts of magnetic flux production
- Magnetic circuit analysis

Course Learning Objectives:
- Students will be able to analyze magnetic circuits.
- Students will be able to resolve three-phase circuit problems.
- Students will be able to analyze basic dc and ac electric machines.
- Students will be able to analyze dc motors.
- Students will be able to analyze synchronous machines.
- Students will be able to analyze induction motors.
- Students will be able to perform basic machinery simulations using software analysis tools (MATLAB).

Topics Covered:
- Three-phase circuits
- Basic magnetic circuits
- Single phase and three phase transformer circuits
- Ac and dc machinery fundamentals
- Synchronous motors and generators
- Dc motors and generators
- Induction motors

Class/Laboratory Schedule: 42 lectures, 7 laboratory sections

Test Policy:
- Tests are closed book.
- Two 8.5 x 11” pages of notes are allowed (both sides of each page)
- Laptops and phones with internet connections are not allowed to be used during tests
- Per university policy, leaving the room during the test should only occur under an emergency situation.
- A calculator is required for tests. Calculators that perform phasor math are allowed and encouraged—but not necessary.
Exams will cover the material from homework assignments, textbook examples and laboratory exercise.

Please do not expect to see exact replications of homework problems on exams. I test to see if the concepts are understood. Typically, this means an application of the concept learned or studied to something practical. I purposely do not weight the homework examinations so much that they drastically affect a student’s grade (i.e. you can do poorly on one exam and still pull off an ‘A’ if you do all of the laboratory assignments, homework, etc.) Performing the examination is intended to be part of the learning process. Try to not stress out excessively over the exam and if you do poorly then learn from your mistakes and move on to do better on the next exam.

I purposely change up exam problems every semester. It is unlikely that you will ever see exact replications of an exam problem from prior semesters.

In-Class Expectations:

- Attendance at all lectures is very important. If you skip lectures you will likely be lost during subsequent lectures because we move across a very wide range of material in a short time period
- This is not a community college class. Therefore, you will be taught the source of the formulas you are using and expected to pull out of the lecture experience the insights you need to do well in the class and use what you have learned in the class throughout your career. Don’t expect to just to get the formulas so you can plug in answers. The main intent is to learn to apply formulas and derive them if necessary—very important career skills for any engineer
- Because of the nature of my research I have to travel quite a bit. So expect there to be substitute instructors sometimes for a 1 to 2-week stretch.
- I do not tolerate harassment of any kind—particularly towards fellow students.
- I do not tolerate the use of profanity in class

Homework Policy:

- Homework problem sets are posted on D2L
- Students will have 2 weeks to complete homework assignments on average
- The content of the homework will be covered in class up to one lecture period before the homework is due—therefore it is important to begin the homework as soon as it is posted and to attempt homework problems as the content is explained in class concurrently. In some cases, it may be necessary for the student to look at the material ahead of coverage in class (i.e. through textbook examples).
- It is the responsibility of the student to exercise whatever means necessary to understand the content of the class. The class lectures are one resource. The textbook is another resource
- Attempts are made to change up the homework problems each semester. In some cases, homework problems may be repeated from semester to semester. If at any time it is obvious that a student has simply copied a prior homework assignment, then the instructor will schedule a meeting with that student and give them a chance to rectify the situation by re-doing the homework. If the student takes no action, then that student can expect to receive 0% credit for the copied homework problem.
- Homework assignments are turned in at the beginning of class on the due date unless the instructor states otherwise
- Homework solutions are posted on D2L after the due date. If a homework is turned in late, the student will not receive full credit.
• In some cases, the instructor may post solutions prior to the homework due date. If this occurs, the instructor will give 100% credit to all homework assignments that are turned in by the due date for each problem that is attempted.
• It is impossible to do well on the examinations without doing the homework. “You learn through your pen” as one of my students says. Or, if you use a pencil then “You learn through your pencil”, whatever.

Laboratory:
• There is a syllabus specifically covering all of the details of the laboratory, including laboratory content, conduct and the logistics of completing laboratory reports. This will be on D2L.
• The first laboratory begins the second week of the semester. Laboratories occur every two weeks thereafter.
• The laboratory performance represents 25% of your grade. Please do not miss laboratory assignments as the missing of one lab could have as much as a full half letter impact on your grade.
• One thing to note: Laboratory note preparation is expected to be an independent activity. Laboratory notes are written up by hand, not electronically, and are to be submitted in the form of a spiral or bound notebook.

Investment of Time by Student:
The average student should expect to spend 10 hours per week on this class, that includes in-class lecture and lab time. Time expectation is broken down as follows (in hours over the total span of the semester):

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-Class Lectures</td>
<td>33.75</td>
</tr>
<tr>
<td>Lecture Note Study Time</td>
<td>27</td>
</tr>
<tr>
<td>Time spent on Homework</td>
<td>50</td>
</tr>
<tr>
<td>In-Class Exam Time</td>
<td>4.5</td>
</tr>
<tr>
<td>Exam Study Time</td>
<td>36</td>
</tr>
<tr>
<td>Lab Time</td>
<td>10.5</td>
</tr>
<tr>
<td>Laboratory Notes Prep Time</td>
<td>10.5</td>
</tr>
</tbody>
</table>

Grading Break-Out:

1st Mid-Term Exam  15%
2nd Mid-Term Exam  15%
Homework           20%
Lab                25%
Final Exam         25%

Academic Misconduct:
Academic misconduct is an act in which a student seeks to claim credit for the work or efforts of another without authorization or citation, uses unauthorized materials or fabricated data in any academic exercise, forges or falsifies academic documents or records, intentionally impedes or damages the academic work of others, engages in conduct aimed at making false representation of a student’s academic performance, or assists other students in any of these acts.

Prohibited conduct includes cheating on an examination; collaborating with others in work to be presented, contrary to the stated rules of the course; submitting a paper or assignment
as one’s own work when a part or all of the paper or assignment is the work of another; submitting a paper or assignment that contains ideas or research of others without appropriately identifying the sources of those ideas; stealing examinations or course materials; submitting, if contrary to the rules of a course, work previously presented in another course; tampering with the laboratory experiment or computer program of another student; knowingly and intentionally assisting another student in any of the above, including assistance in an arrangement whereby any work, classroom performance, examination or other activity is submitted or performed by a person other than the student under whose name the work is submitted or performed.

An instructor who believes a student has engaged in academic misconduct first discusses the matter with the student. Following the meeting, if the instructor concludes that misconduct occurred, the instructor may impose a sanction of reprimand, a repeat assignment, lower or failing grades for the assignment or course, or removal from the course. All sanctions may be appealed to a hearing committee.

An instructor who considers the misconduct to be serious enough to warrant probation, suspension or expulsion makes such a recommendation to the appropriate investigating officer (IO) who is an appointee of the dean in the student’s school or college. If after discussions with the student the IO agrees with the instructor’s recommendation, a hearing is scheduled before the academic misconduct hearing committee corresponding to the students status (undergraduate or graduate). Relative to such hearings students have a right to a written notice of the alleged offense and sanction sought, to question adverse witnesses, to be heard and present evidence, to be represented and obtain a record of the hearing at student expense and to a written decision and a copy of all applicable procedures. Students who are suspended or expelled by a hearing committee may appeal to the Chancellor.

Suspensions and expulsions bar enrollment at any campus in the UW System. Students may petition for readmission after half of the suspension period, in the case of suspensions, or one year in the case of expulsions.

Records of all disciplinary actions are maintained by the Dean of Students.

**Contribution of Course to Meeting the Professional Component of ABET Accreditation:**

This course contributes to the engineering sciences component of the curriculum. Students learn fundamental electrical engineering science concepts related to electric machinery and power systems.