Electromechanical Energy Conversion: ELECENG 362, Spring 2026

Credits: 4
Meeting Times: TR 4:00-5:15pm
Location: Lubar Hall N110

Instructor

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Teaching Assistant

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Welcome Statement:
Welcome to ELECENG 362 course! I'm really glad you're here. I believe that every one of you is fully capable of engaging with and mastering the material in this course. My goal is to meet you where you are and support you as we learn together.

Course Overview:
Principles of electrical and electromechanical energy conversion; transformers, polyphase induction and synchronous machines, DC machines, single-phase motors, including design parameters and testing.

Course Objectives:
The objectives of this course are to:

- Develop a strong conceptual and analytical foundation in electromechanical energy conversion.
- Connect electromagnetic fundamentals to the operation and performance of transformers and electric machines.
- Strengthen problem-solving skills for 3-phase systems, machine equivalent circuits, and steady-state performance analysis.
- Provide hands-on and computational experience through laboratory exercises and basic simulation tools (e.g., MATLAB).

Student Learning Outcomes:
Upon successful completion of this course, students will be able to:

- Analyze magnetic circuits and compute flux, inductance, and stored energy for typical machine/transformer structures.
- Solve balanced 3-phase circuit problems, such as phasor-domain analysis and power calculations.
- Derive and use transformer equivalent circuits to predict voltage regulation, efficiency, and performance under load.
- Analyze DC machines and DC motors, including torque-speed characteristics and operating modes.

- Analyze synchronous machines, including excitation effects, power-angle relationships, and power factor control.
- Analyze induction motors using equivalent circuits to compute torque, slip, losses, and efficiency.
- Perform basic electromechanical system simulations using MATLAB to support machine performance evaluation and interpretation of results.

Prerequisites and/or Special Skills Required:

- **Prerequisites by Courses:**
  - ELECENG 234(P): Analytical Methods in Engineering
  - ELECENG 301(P): Electrical Circuits and Electronics I
- **Prerequisites by Topics:**
  - 3-phase power system analysis
  - Phasor math
  - Concepts of electrical conductivity and resistivity
  - Concepts of magnetic flux production
  - Magnetic circuit analysis
- **Prerequisites by Skills:**
  - MATLAB/Simulink

Course Modality and Format:

- **Format:** Lecture, presentations.
- **Modality:** In-person.

Course Materials:

- **Textbook:**
  - Fitzgerald & Kingsley's Electric Machinery, **7th Edition**, by Stephen S. Umans; McGraw-Hill, 2014 (**ISBN10**: 0073380466 and **ISBN13:** 9780073380469)
  - Electric Machinery, **6th Edition**, by A. E. Fitzgerald, Charles Kingsley, Stephen S. Umans; McGraw-Hill, 2002 (**ISBN10**: 0073660094 and **ISBN13:** 9780073660097)
- **Lectures**
- **Course Notes**

Time Investment:

This is a four-credit course. Consistent with university and accreditation guidelines, the expected total time commitment for the average student is approximately 192 hours over the semester (i.e., approximately 48 hours per credit). This total includes in-class lecture and laboratory time as well as independent work outside of class. While the exact distribution of time will vary by student and by week, the following breakdown represents a reasonable expectation for successful completion of the course:

Activity	**Estimated Hours**
In-class lectures (150 min/week * 15 weeks)	37.5
In-class laboratory sessions	30.0
Studying lecture notes and assigned readings	45.0
Homework problem solving and analysis	50.0
Exam preparation and review	24.0
In-class examinations	5.5
Total Estimated Time Commitment	192

- I wish to emphasize that the workload is an estimate and that students are assessed on their performance, not on the time put into the course.

Assignments & Grading:

- There will be 2 exams and 1 final exam. You are expected to be present, seated, and ready to take the exam before the exam begins. You are not permitted to use any outside materials, resources, or electronic devices (including but not limited to mobile phones, smartwatches, etc., but not including a calculator) on the exams. There will be no make-up exams, even in the case of an emergency. A missed exam counts as a zero unless a valid excuse from a physician or the Dean's Office is presented to your instructor. With an acceptable written excuse, a missed exam score will be replaced with the percentage earned on the corresponding subsection of the final exam. The final exam is comprehensive. If a student has a conflict with another final exam, the student must contact their instructor at least 2 weeks in advance in order to have it resolved.
- The course grade is determined by the following components:

1st Midterm Exam	15%
2nd Midterm Exam	15%
Homework	20%
Lab	25%
Final Exam	25%

- Below is a break-out grading scale:

A	93-100
A-	90-92
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	63-66
D-	60-62
F	0-59

Course Policies:

- **Class Attendance and Participation:**
  - 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:**
  - Homework problem sets are posted on Canvas.
  - 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 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 Canvas 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.

- **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 Canvas.
  - The lab performance represents 25% of your grade. Please do not miss lab 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.
- **Exams:**
  - Exams are closed book.
  - Laptops and phones with internet connections are not allowed to be used during exams.
  - Per university policy, leaving the room during the exam should only occur under an emergency situation.
  - A calculator is required for exams. Calculators that perform phasor math are allowed and encouraged, but not necessary.
  - Exams will cover the material from homework assignments, textbook examples, and laboratory exercises.
  - 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.
- **Academic Integrity Policy:**
  - UWM defines academic misconduct as any action by a student to falsely claim credit for someone else's work, use unauthorized materials, fabricate data, forge academic

documents, impede others' academic work, misrepresent academic performance, or assist others in such acts.

- 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. 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.
- Here is additional UWM information on academic misconduct.

- **Policy on Artificial Intelligence:**
  - In this course, the use of **Generative Artificial Intelligence (AI) tools**; including but not limited to ChatGPT, Google Bard, Gemini, Copilot, Claude, and similar systems; is **not permitted** for any course assignments, assessments, homework, projects, or examinations unless explicitly authorized by the instructor. This prohibition covers the use of AI to generate text, solve problems, summarize concepts, or produce content in whole or in part. Using AI tools in any way for graded coursework will be considered **academic misconduct** under UWM Academic Integrity Policy (UWS Chapter 14). If you are unsure whether a specific tool or use is allowed, you must discuss it with the instructor before submitting any work.

University Policies:

- **Statement on Hate/Bias Incidents:** UWM is committed to creating and supporting a campus climate that is respectful and supportive of all who study, live, or work on campus, or participate in campus activities. UWM students and employees who have been subjected to, or who have witnessed, an incident of bias or hate are encouraged to submit a hate/bias incident report. UWM can provide support or resources to those involved in the incident. Find more information about hate- or bias-motivated incidents, as well as UWM's Discriminatory Conduct Policy and other resources, on UWM's hate/bias webpage.
- **UWM Syllabus link:** Please read through UWM Syllabus Links page, which details policies pertaining to students with disabilities, absences due to religious observation, students called to active military duty, incompletes, discriminatory conduct, Title IX, academic misconduct, complaint procedures, grade appeal procedures, LGBT+ resources, and final exam policies.

How To Be Successful in This Course:

- **Student's Responsibility:**
  - Be prepared for all classes
  - Be respectful of others
  - Actively contribute to the learning activities in class
  - Abide by the University Academic Integrity Policy
- **Instructor's Responsibility:**
  - Be prepared for all classes
  - Evaluate all fairly and equally
  - Be respectful of all students
  - Create and facilitate meaningful learning activities
  - Behave according to University codes of conduct

Instructor Statement of Support:

- I realize reading this syllabus from beginning to end makes the course look daunting! Please know that I am aware of how much I am asking from you. Even so, I believe every one of you can succeed in this course, but that will require you to work hard and reach out when you need help!
- This syllabus is a living document and is subject to revision. Revisions will never negatively impact a student and will only be done in cases of clarity or grammar.

Contribution of Course to Meeting the Professional Component of ABET:

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.