

Course Syllabus
ELCT 553 – Electromechanical Energy Conversion
MW 2:20pm-3:35pm, Swearingen 2A22

Course Coordinator

Prof. Adel Nasiri

Catalog Description

Analysis and design of electromechanical energy conversion systems, including electrical machines and electronic drives.

Course delivery structure:

Lectures

Credit Hours: 3

Prerequisite(s) by course

ELCT 331 and ELCT 361

Prerequisite by topics

Electrical Circuits and Electromagnetics

Required Textbooks and other materials

1. Fitzgerald, A. E., Kingsley, C., & Umans, S. D. (2014). Electric machinery (7th ed.). New York, NY: McGraw-Hill, ISBN 978-0-07-338046-9.
2. Class notes posted on Blackboard.
3. Computer and internet access.

Supplemental materials

Recommended: MATLAB/Simulink and MathCad for homework and project submission.
All readings/materials comply with copyright/fair use policies.

Learning Outcomes:

Learning Outcomes for ELCT 553 are equivalent for all delivery methods.

Students who successfully complete the course will be able to:

1. Analyze magnetic circuits.
2. Understand and apply the theory of electromechanical energy conversion.
3. Analyze AC machines, including motors and generators.
4. Analyze DC machines, including motors and generators.
5. Design systems including transformers, generators and motors.

Graduate and honors students who successfully complete this course will in addition be able to:

6. Conduct a research simulation project based on one of the course topics.

Course Topics:

- Magnetic circuits and materials
- Transformers
- Electromechanical energy conversion
- Machine fundamentals
- Synchronous machines
- Induction machines
- DC machines
- Other machines
- Drives and controls

Course Contribution to ABET Program Outcomes:

ELCT 553 contributes to an achievement of:

- Outcome 1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- Outcome 2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- Outcome 5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- Outcome 6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.
- Outcome 7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Tests, Final Exam, Laboratory, and Homework Schedules*:

Item	Date and Time	Percent
Test I (1.25 hours)	February 16, 2014	15%
Test II (1.25 hours)	April 6, 2014	15%
Final Exam (2.5 hrs)	12:30pm-3:00pm; Monday, May 4	30%
Homework	Assigned regularly at the end of each class	20%
Total Points		100%

* Dates are subject to changes.

Grading Scale:

89.5% - 100% = A
84.5% - 89.4% = B+
79.5% - 84.4% = B
74.5% - 79.4% = C+
69.5% - 74.4% = C
64.5% - 69.4% = D+
59.5% - 64.4% = D
0% - 59.4% = F

Notes:

- All tests and final exam are taken in the classroom: Swearingen 2A22.
- Homework and Test Solutions - Show all work to obtain answers.
- Tests: Open book, open notes; **no communication device or regenerative AI access is allowed.**
- Homework exercises will be assigned in due time.
- Late homework will be graded at 50% maximum credit, and will be accepted no later than one class period past due date.

- Regularly check the Blackboard for new assignments, test schedule, solutions of selected problems, and other helpful information.

Course Schedule:

Week/Dates	Topics	Textbook Sections
01 (Jan 12, Jan 14)	Course Outline; Review of Basic Electrical Circuits, Three-Phase, and Magnetic Circuits	1.1-1.3
02 (Jan 21)	Jan 19 is MLK Day. Review of Magnetic Circuits; Single and Three Phase circuits	1.4-1.6, A.2-A.4
03 (Jan 26, Jan 28)	Transformers: Basics and Single & Three Phase	2.1-2.3
04 (Feb 2, Feb 4)	Transformers: Single & Three Phase; Per Unit System (Single Phase)	2.4-2.5 2.6-2.7 2.9
05 (Feb 9, Feb 11)	Per Unit System (Three Phase); Review	2.9
06 (Feb 16, Feb 18)	Test 1 (Feb 16) Co-energy, Magnetic Force and Torque	3.1-3.2
07 (Feb 23, Feb 25)	Co-energy, Magnetic Force and Torque; Introduction To Rotating Machines and MMF	3.3-3.6 4.1-4.3
08 (March 2, March 4)	Fields, MMF, Generated Voltage in Rotating Machines	4.4-4.6
09 (March 9, March 11) Spring Break		
10 (March 16, March 18)	Torque in Rotating Machines	4.7, 4.9 – 4.10
11 (March 23, March 25)	Synchronous Machines: Basics and Equivalent Circuit	5.1 – 5.3
12 (March 30, April 1)	Synchronous Generators/Motors: Steady State Operation Review	5.4 – 5.5
13 (April 6, April 8)	Test 2 (April 6) Induction Motors: Basics and Equivalent Circuit	6.1 – 6.3
14 (April 13, April 15)	Induction Motors: Parameter Determination	6.4 – 6.6
15 (April 20, April 22)	Induction Motors: Steady State Operation; DC Machine Fundamentals	7.1 – 7.6
16 (April 27, April 29)	DC Generators/Motors: Steady State Operation; Review	7.8 – 7.9
17 (May 4)	Final Exam (May 4) 12:30pm-3:00pm	

Generative Artificial Intelligence (GenAI) Policy

Students are encouraged to use generative AI tools in coursework

The use of generative AI is encouraged with certain tasks and with attribution: You can choose to use AI tools to help brainstorm assignments or projects or to revise existing work you have written. When you submit your assignment, I expect you to clearly attribute what text was generated by the AI tool (e.g., AI-generated text appears in a different colored font, quoted directly in the text, or use an in-text parenthetical citation).

Disability Services

The [Student Disability Resource Center](http://www.sa.sc.edu/sds/) (SDRC) (<http://www.sa.sc.edu/sds/>) empowers students to manage challenges and limitations imposed by disabilities. To receive reasonable accommodations from me, you must be registered with the Student Disability Resource Center (1705 College Street, Close-Hipp Suite 102, Columbia, SC 29208, 803-777-6142). Any student with a documented disability should contact the SDRC to arrange appropriate accommodation. Once registered, students with disabilities are encouraged to contact me (within the first week of the semester) to discuss the logistics of any accommodation needed to fulfill course requirements.

Mental Health and Well-Being

If stress is affecting your ability to complete schoolwork, maintain relationships, eat, sleep, or enjoy life, please reach out to any of USC's mental health resources. Most of these services are offered at no cost, as they are covered by the Student Health Services tuition fee. For a complete list of available mental health resources, refer to the quick reference list below and visit [Student Health and Well-Being](https://sc.edu/about/offices_and_divisions/student-health-well-being/index.php) (https://sc.edu/about/offices_and_divisions/student-health-well-being/index.php).

- **Wellness Coaching** can help you improve in areas related to emotional and physical well-being (e.g., sleep, resiliency, balanced eating, and more). Schedule an appointment at (803) 777-6518 or through [MyHealthSpace](https://myhealthspace.ushs.sc.edu/) (<https://myhealthspace.ushs.sc.edu/>)
- **Therapy Assistance Online (TAO) by Uplift** (<https://us.taoconnect.org/login>) offers virtual self-help modules. See [TAO registration](https://us.taoconnect.org/register) (<https://us.taoconnect.org/register>).
- **Counseling & Psychology Services (CAPS)** offers individual and group counseling, as well as psychiatric services. Schedule an appointment at (803) 777-5223 or through [MyHealthSpace](https://myhealthspace.ushs.sc.edu/) (<https://myhealthspace.ushs.sc.edu/>).
- **24-Hour Mental Health Support Line:** Call (833) 664-2854 for immediate support.
- **Anonymous Mental Health Screening:** Take an anonymous [mental health screening](https://www.uscscreening.org/welcome.cfm?access=website) (<https://www.uscscreening.org/welcome.cfm?access=website>).

Academic Integrity Statement

As a partner in your learning, it is important to both of us that any assignment submission is a pure reflection of your work and understanding. Suspicions of alleged violations of Cheating – defined as “unauthorized assistance in connection with any academic work” and/or Falsification, which includes “Misrepresenting or misleading others with respect to academic work or misrepresenting facts for an academic advantage” – will be referred to the Office of Academic Integrity.

You are expected to practice the highest possible standards of academic integrity. Any deviation from this expectation will result in a minimum academic penalty of your failing the assignment

and will result in additional disciplinary measures. This includes improper citation of sources, using another student's work, and any other form of academic misrepresentation.

The first tenet of the Carolinian Creed is, "I will practice personal and academic integrity."

Below are some websites for you to visit to learn more about university policies:

- [Carolinian Creed](https://sc.edu/about/offices_and_divisions/student_affairs/our_initiatives/involvement_and_leadership/carolinian_creed/index.php)
(https://sc.edu/about/offices_and_divisions/student_affairs/our_initiatives/involvement_and_leadership/carolinian_creed/index.php)
- [Academic Responsibility](http://www.sc.edu/policies/staf625.pdf) (<http://www.sc.edu/policies/staf625.pdf>)
- [Office of Student Conduct and Academic Integrity](https://www.sa.sc.edu/academicintegrity/)
(<https://www.sa.sc.edu/academicintegrity/>)
- [Information Security Policy and Standards](https://sc.edu/about/offices_and_divisions/division_of_information_technology/security/policy/index.php)
(https://sc.edu/about/offices_and_divisions/division_of_information_technology/security/policy/index.php)

Plagiarism

The course homework, quizzes, and exams are designed and intended as individual works. Although discussions and collaborations are encouraged, copying the works are strictly forbidden. Copied work will receive zero point and the student will be reported for academic misconduct review. Using the words or ideas of another as if they were your own is a serious form of academic dishonesty. If another person's complete sentence, syntax, key words, or specific or unique ideas and information are used, you must give that person credit through proper citation.

Student Success Center

Undergraduate Student Support

In partnership with USC faculty, the [Student Success Center](https://sc.edu/about/offices_and_divisions/student_success_center/index.php) (SSC) (https://sc.edu/about/offices_and_divisions/student_success_center/index.php) offers several programs designed to help you better understand your course material and to support your academic success. SSC programs are led by professional staff, graduate students, and trained undergraduate peer leaders who have previously excelled in their courses. Resources available to you in this course may include:

- **Peer Tutoring:** Schedule a one-on-one appointment with a [Peer Tutor](http://www.sc.edu/success) (<http://www.sc.edu/success>). Drop-in and Online Tutoring may also be available for this course. Visit the website for a full schedule of times, locations, and courses.
- **Supplemental Instruction (SI):** SI Leaders are assigned to specific course sections and hold three weekly study sessions focused on the most challenging course content. The SI session schedule is posted on the SSC website each week and will also be communicated in class by the SI Leader.
- **Peer Writing:** Improve your college-level writing skills by bringing writing assignments from any of your classes to a Peer Writing Tutor. You can schedule an appointment through the website and view the full schedule of available drop-in hours and locations.
- **Success Consultations:** SSC staff offer personalized consultations to help you develop study skills, set academic goals, and connect with campus resources. Throughout the semester, I may communicate with the SSC about your progress to ensure your success in this course. If the SSC contacts you, please schedule a Success Consultation promptly. Referrals are not punitive, and any information shared is confidential under FERPA privacy laws. Student Success Center services are available to all USC undergraduates at no additional cost. To check the schedule and make appointments, please call 803-777-1000, visit <http://www.sc.edu/success>, or stop by the Student Success Center in the Thomas Cooper Library (Mezzanine Level).

This course may participate in the university's Progress Report/Alert Initiative. At key points throughout the semester, the instructor may notify the Student Success Center and/or University Advising Center about students who may not be meeting established criteria for attendance, grades, or assignment performance. Students who receive an alert may get an e-mail, phone call or text message from their Academic Advisor and/or the Student Success Center, encouraging them to connect with additional academic support resources.

Graduate Student Support

The [Student Success Center](https://sc.edu/about/offices_and_divisions/student_success_center/population-specific-support/graduate-student-support/index.php) (SSC) (https://sc.edu/about/offices_and_divisions/student_success_center/population-specific-support/graduate-student-support/index.php) offers all graduate students time management, study skills and money management support through one-on-one consultations, workshops and accountability groups. In-person and virtual options are available. Visit the graduate student support website for more information and to make an appointment.