ECE 331 - Electromechanical Energy Conversion

Catalog Description: Energy conversion principles for electric machines. Steady state characteristics of direct current, induction, and synchronous machines. Application of stepper and servo motors, and synchronous generators.

Credits: 4 Terms Offered: Winter

Prerequisites: ENGR 202
Corequisites: None
Courses that require this as a prerequisite: NA

Structure: Two 110 minute lectures per week.

Instructors: Ted Brekken

Course content:

- Magnetic circuits, magnetic materials, permanent magnets, non-linear magnetic circuits, single-and-three-phase transformers.
- Balanced wye and delta-connected three-phase circuits with measurements of active and reactive power.
- Principles of electromechanical energy conversion.
- Three-phase induction machines.
- Single-phase induction machines.
- Three-phase synchronous machines: wound rotor and permanent magnet.
- Direct-current machines.
- Stepper motors.
- Regenerative braking.
- Introduction to drives and power electronics in control of electric machines, including switch-mode PWM converters for drives applications.

Measurable Student Learning Outcomes:
Upon completing this course, students will be able to...

1. Analyze the performance of single- and three-phase transformers (ABET Outcomes A, c, e, k)
2. Analyze the performance of three-phase induction motors and generators (ABET Outcomes A, c, e, k)
3. Analyze the performance of synchronous motors and generators (ABET Outcomes A, c, e, k)
4. Analyze the performance of dc motors and generators (ABET Outcomes A, c, e, k)
5. Analyze the performance of stepper motors (ABET Outcomes A, c, e, k)
6. Identify the differences of design, construction and application between induction, synchronous, stepper, and dc motors (ABET Outcomes A, C, E, j, k)
7. Analyze power electronics used in the control of electromechanical machines (ABET Outcomes A, C, E, j, k)
Learning Resources:

Evaluation of Student Performance:
- 30% Homework
- 30% Midterm
- 40% Final

Accommodations:
Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 541-737-4098. The University will grant students reasonable requests for religious accommodations where doing so does not conflict with reasonably necessary University goals (reasonable accommodation). The Religious Accommodation Policy document is maintained in the Office of Equity and Inclusion oregonstate.edu/oei/religious-accommodation-policy

Expectations for student conduct:
In an academic community, students, faculty, and staff each have responsibility for maintaining an appropriate learning environment, whether online or in the classroom. Students, faculty, and staff have the responsibility to treat each other with understanding, dignity and respect. Disruption of teaching, administration, research, and other institutional activities is prohibited by Oregon Administrative Rule 576-015-0015 (1) and (2) and is subject to sanctions under university policies (oregonstate.edu/studentconduct/home/).

Revised: 9 May 2018