

## Syllabus

### **General Information**

**Semester:** Fall 2021

**Course:** ECE 8930 Design of Rotating Electrical Machinery

**Instructor:** Professor Chris S. Edrington

**Email:** cedring@clemson.edu

**Location:** 213 Riggs Hall, Clemson University

### **Prerequisites**

Graduate standing

### **Purpose of Course**

The purpose of this course is to provide information dissemination of material relevant to the design of rotating electrical machinery. Often machines are selected for applications without knowledge of the characteristics and behavior of that specific machine topology. Possessing a thorough knowledge of how machines are designed and how those design considerations intersect with the physical constraints, impact of power electronics, and control strategies is paramount in the context of choosing the most appropriate machine for the overall benefit of the intended application.

### **Course Objectives**

1. Understand the basic physics and mathematics that are involved in machine design
2. Understand the guiding principles that are required for basic designs
3. Understand the differences and applicability of various steels for machines
4. Understand the how the MMF is distributed in the machine.
5. Understand the thermal requirements for electrical machines
6. Understand the role of dielectric and insulating materials

### **Topics Covered:**

1. Magnetic Circuits
2. MMF and Field Distribution of an AC Winding
3. Main Flux Path Calculations using Magnetic Circuits
4. Leakage Reactance Calculation using Magnetic Circuits
5. Calculation of Induction Machine Losses
6. Steels for Rotating Machinery
7. Principles of Design
8. Thermal Design
9. Machine Specific Dielectric Materials

### **Course textbook**

No text will be required for this course, since the lecture notes will be supplied to the students from the professor and come from a variety of sources such as P. Beckley, T. Lipo, D. Hanselman, and I. Boldea.

### **Class meetings**

Tuesday and Thursday from 8:00am to 9:15am

**Office hours**

Office hours will be by appointment. Given the nature of COVID-19 and the dynamically changing environment, there is no guarantee they can be in person and may need to be conducted virtually.

**Credits**

3 credit hours

**General course policies**

**Exams:**

There are no exams for this course.

**Make-up Policy:**

- There will be no make-up work for homework, projects, presentation or quizzes; late work will be given a zero.
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**Grade Distribution:**

Presentation 1 .....	25%
Project 1 .....	25%
Quizzes.....	40%
Homework.....	10%

**Grading Scale:**

- A = 90 – 100%
- B = 80 – 89.9%
- C = 70 – 79.9%
- F = 60 – and below

In general there will be no mathematical calculation for curving of grades. I reserve the right to adjust this grading scale down if it is justifiable.

**Coursework:**

**Quizzes:** Quizzes will consist of problems that have been related to the lecture. In general there will be a quiz every week to two week. Typically they are 5 problems that are short answer, multiple choice, or True/False

**Projects:** These may be very open-ended requiring you to use engineering judgment backed up by simulation results and analysis. Projects will be written in any business format you chose. Depending on class size and composition these may be team or individual problems at the discretion of the professor. You should treat these more like you are an engineering consultant who is trying to specify the machine/drive for the application and trying to sell it some a group of venture capitalists or angle investors. Thus it should be technically correct but also compelling.

**Presentations:** Presentations will be required for the project. Scoring will be based on such items as technical competency, professionalism of the presentations, graphical content etc.

### **Attendance policy**

- Students at Clemson are expected to wait 15 minutes if an instructor is late. Attendance of class is in your best interest. The instructor will not be responsible for missed quizzes, homework assignments or other information imparted that could have been obtained by the student if they had been in attendance. The instructor will not keep role, however, with a class less than 30 students it is very easy to determine if a student is consistently missing. If attendance does become an issue, the instructor reserves the right to have “pop quizzes” or to institute a “roll call” that will affect your overall “quiz grade” score.
- Note, that it is a high risk proposition to not attend class. There is no guarantee that the lecture will be recorded that day since there could be a technical issue.

### **Inclement Weather Policy**

- Since all homework will be uploaded directly to Canvas, inclement weather will not affect the submission of homework
- Since all projects will be uploaded directly to Canvas, inclement weather will not affect the submission of projects
- Since quizzes are conducted during class time, inclement weather that causes the cancelation of classes will result in the quiz being conducted during the next available class period

### **Commitment to Diversity**

The College of Education is committed to providing all candidates with purposeful, challenging, and diverse experiences. It is through a range of diverse, carefully constructed, and challenging classroom-based instruction and field-based experiences that candidates will recognize the inherent dignity and value of all individuals, promote equity in education, and advocate on behalf of children, families, and communities. <http://www.clemson.edu/education/about/diversity-plan/index.html>

### **Accreditation and Assessment Practices:**

Clemson University and the College of Engineering, Computing and Applied Sciences are required to collect candidate performance data for national, regional and state accreditation.

### **Academic Integrity Policy**

“As members of the Clemson University community, we have inherited Thomas Green Clemson’s vision of this institution as a “high seminary of learning.” Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.”

Please refer to the “Academic Integrity Policy” <http://www.clemson.edu/academics/academic-integrity/index.html>

### **Accommodations for Students with Disabilities**

Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities,

course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to this class should let the professor know, and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848, by emailing [studentaccess@lists.clemson.edu](mailto:studentaccess@lists.clemson.edu), or by visiting Suite 239 in the Academic Success Center building. Appointments are strongly encouraged – drop-ins will be seen if at all possible, but there could be a significant wait due to scheduled appointments. Students who receive Academic Access Letters are strongly encouraged to request, obtain and present these to their professors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information here: <http://www.clemson.edu/campus-life/campus-services/sds/>.

### **Clemson University Title IX Statement**

Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This policy is located at <http://www.clemson.edu/campus-life/campus-services/access/title-ix/>. Clemson University's Title IX Coordinator is located at 110 Holtzendorff Hall, 864.656.3184 (voice) or 864.656.0899 (TDD).

### **Academic Continuity Plan for this Class**

Clemson has developed an academic continuity plan for academic operations. Should University administration officially determine that the physical classroom facility is not available, class will be conducted in a virtual (online) format. The University issues official disruption notifications through email/ www/ test notification / social media. When notified, use one of the following links to navigate for Clemson Canvas, where you will find important information about how we will conduct class:

- Primary access link: [www.clemson.edu/canvas](http://www.clemson.edu/canvas)
- Secondary access link, if needed: <https://clemson.instructure.com/>
- You can also use the Canvas Student App.

Our activities for teaching and learning will occur through our Canvas course.

In the event of an E-learning Day, a real-time test of the academic continuity plan will be conducted. Our class will be conducted via Canvas. Detailed instructions will be published at Canvas before an E-learning day.

### **Emergency Guidelines from Clemson University Police Department**

All students and employees should be familiar with the following guidelines. For additional information about safety see <http://www.clemson.edu/cusafety/preparedness/>.

Evacuation:

- When evacuating buildings, do not use elevators as they may lose power, stranding riders.
- Familiarize yourself with the locations of stairwells and exits.

- Individuals needing assistance evacuating should move to a stairwell away from the hazard, dial 911, and provide the Dispatcher with their exact location and what they need regarding evacuation.
- When evacuating follow the instructions provided by Public Safety personnel to reach a safe place.

To seek “Tornado Safer Places,” get to the lowest level of the building time allows, stay away from areas with windows and glass, and put as many walls as you can between yourself and the outside. In public buildings, bathrooms typically have an additional wall.

**Active Shooter:**

- Always call 911 as soon as you possibly can.
- Run away from the area, if it is safe to do so, time allows and the gunman is not nearby.
- Hide if the gunman is too close to your location. Find a safer place, lock and barricade doors, turn lights out and cell phones off or to vibrate.
- Fight. As a last resort, resolve to fight the intruder with everything you have at your disposal.

A short video prepared and presented by the Department of Homeland Security can be found at the following link: [dhs.gov/video/options-consideration-active-shooter-preparedness-video](https://www.dhs.gov/video/options-consideration-active-shooter-preparedness-video).

**The following is information regarding UCG safety/security:**

- UCG is under the jurisdiction of the Greenville City Police Department (911 for emergencies) and the Greenville Technical College Police Department ([864-250-8911](tel:864-250-8911))
- UCG is open from 8:00am to 9:00pm (Monday through Thursday), 8:00am to 5:00pm (Friday); during this time, a Greenville Technical College Safety Officer is on-site at McAlister Square
- The Greenville City Police Department has a "Police Sub-Station" in the Publix on the property at McAlister Square
- UCG has administrative/library and technical support staff on site from 8:00am to 9:00pm (Monday through Thursday), 8:00am to 5:00pm (Friday)
- The Greenville Technical College Safety Officer can be called to escort students to the parking lot after dark if necessary
- There are emergency phones on the second floor of UCG that immediately call Greenville Technical College Dispatch when the headset is picked up
- Each University "store-front" suite and the UCG reception desk all have emergency buttons that instantly call Priority1 Security who calls Greenville Technical College Police to respond if the button is pushed
- UCG has numerous internal and external high definition security cameras and a 1 Terabyte security recording system
- All entrance and exit doors at UCG function the same from 8:00am to 9:00pm (Monday through Thursday), 8:00am to 5:00pm (Friday)
- UCG is also open from 8:00am to 5:00pm on Saturday and the library only from 1:00pm to 5:00pm Sunday.

**Copyright Statement**

Materials in some of the courses are copyrighted. They are intended for use only by students registered and enrolled in a particular course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Students should be reminded to refer to the Use of Copyrighted Materials and “Fair Use Guidelines” policy on the Clemson University website for additional information: <http://www.clemson.edu/library/>

### **Privacy Policy**

This course is designed with your privacy in mind. If, however, you feel that an assignment or technology tool undermines your right to privacy, please contact me immediately. We will work together to determine an alternative assignment that will help you achieve the course learning outcomes.

### **Student Success Resources**

The Graduate School maintains a collection of resources applicable to graduate students, listed here: <https://www.clemson.edu/graduate/students/> (visit this page for professional development, governance, the handbook, and thesis/dissertation resources) and here: <https://www.clemson.edu/graduate/students/resources.html> (for links regarding education, student life, and health and safety).

### **Syllabus Status:**

This syllabus is a living document that is subject to change. Changes will only be made in the advent that an error is found in the syllabus. Any change will not impact the student in a negative manner.