Course Syllabus

ELCT 451 – Power System Design and Analysis

Course Coordinator

Power & Energy Systems Group – EE Department, Undergraduate Program Committee

Catalog Description

Electric power systems including transformer fundamentals, per-unit analysis, transmission and distribution line design, and power flow analysis.

Course delivery structure:

Lectures

Credit Hours: 3

Prerequisite(s) by course

ELCT 331

Prerequisite by topics

Control Systems

Required Textbooks and other materials

1. Power System Analysis and Design, 6th edition, by J.D. Glover, M.S. Sarma & T. Overbye, ISBN-13: 978-1305632134, ISBN-10: 1305632133
2. Power World (http://www.powerworld.com/gloversarmaoverbye) or MATLAB Simulink
3. Class notes posted on Blackboard
4. 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:

Students who successfully complete the course will be able to:

1. Review AC circuit phasor analysis.
2. Simplify steady-state three-phase sinusoidal circuits to analyze as a single-phase circuit.
3. Analyze steady-state three-phase sinusoidal power systems.
4. Analyze power system problems using the per-unit system.
5. Conduct power flow studies on multiple-bus AC power systems.
6. Understand the nomenclature and layout of power delivery systems.
7. Utilize software tools in the simulation and analysis of power systems.
8. Write a technical document to support project results.

Course Topics:

- Introduction to Power Systems
- Three-phase circuit review
- Transformer basics
- Transmission and distribution lines
- Power-flow studies
- Introduction to system operation and control

Course Contribution to ABET Program Outcomes:

ELCT 451 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 6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusion.
- Outcome 7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Course Information

Instructor: Dr. Adel Nasiri
Class Location: 2A15 Swearingen
Class Meeting Time: MW 2:20 – 3:35 pm ET
Lecture Type: Traditional

Office: Swearingen 3A32
Phone: 803-576-7796
E-mail: nasiri@sc.edu

Office hours: MW 10am – 11am ET or by appt

Graduate students are required to complete additional work. These students may have additional question(s) on homework assignments. Exams may have an additional question or a replacement question of higher difficulty. Class participation is expected by all students.

Class Requirements	All Undergraduates
Homework	20%
Quizzes	5% (bonus)
Exam 1	20%
Exam 2	20%
Project	15%
Final Exam	25%

Approximate grading scheme is as follows**:**

Final Grade	Semester Average
A	90 - 100
B+	86 - 89
B	80 - 85
C+	76 - 79
C	70 - 75
D+	66 - 69
D	60 - 65
F	Below 60

Exam Dates:

Exam 1	Wednesday, Oct 4th
Exam 2	Wednesday, Nov 13st
Final Exam	Wednesday, Dec. 13 - 12:30 pm

Assignment Submissions

All assignments will be submitted to the appropriate Blackboard link by 11:55 pm ET on the due date.

Any handwritten assignments that are illegible will be returned without review. If you have poor handwriting, I recommend typing your assignment using LaTeX, Microsoft Word, or other word processor. All assignments should be submitted as PDFs in the following format:

LastName_FirstName_ELCT551_SEC_XXXX_YY.pdf

where SEC is your section number, XXXX is HMWK, PROJ, or EXAM, and YY is the homework number if needed.

Partial credit will be earned for the clear presentation of all the steps involved in solving all problems. Sketches should be included as necessary. Answers, including appropriate units, should be clearly identifiable.

Project Requirements

The project will consist of developing a power system in Matlab/Simulink and analyzing the power flow. Hand calculations will be used to verify the results. The project will be compiled into a technical report for submission. Additional information will be provided at the time of assignment.

Course Communications

The instructor communicates with students using Blackboard announcement, Blackboard chat, Blackboard Collaborate tools. *Email is the least preferred method unless it is an individual matter.* Per student request, group, or individual online meetings, Q&A and consultation sessions can be arranged.

The instructor will return graded assignments within one week of submission and will respond to Blackboard discussion board messages within 24-48 hours.

Instructional Methods

The course will be taught using multiple instructional methods. These methods will include in class sessions, online lecture videos, YouTube videos, group projects, and video presentations.

Attendance Policy

Students are expected to attend each scheduled class meeting, to be on time, and to be prepared for each class session. Please DO NOT come to class late as it disturbs the class.

Make-up Policy

Make-up exams or assignments will only be allowed for students who have an excuse approved by the instructor before the due date, except in emergency situations. Acceptable reasons for delayed submissions include severe illness or immediate family emergencies. Make-up exam format and questions for excused absences may be different than the original exam.

Minimum Technology Requirements

Every EE class requires routine computer and online skills such as use of Blackboard Learning Management system (LMS), VPN, and composition of documents. In addition, this class has the following requirements:

- Students are encouraged to have laptops, tablets, or phones with internet access during every class session to access the above LMS and/or other tools used in the course.
- Students are expected to have sufficient skills and user credentials to download, install, and access the software required for the course: MATLAB/Simulink.
- Please contact your instructor or UTS if you need help with internet access setup, software installation or usage.

Graduate students must also have proficiency in:

- Literature searches through a research database (IEEE Xplore or UofSC library)

Diversity and Inclusivity Statement

The university is committed to a campus environment that is inclusive, safe, and respectful for all persons, and one that fully embraces the Carolinian Creed. To that end, all course activities will be conducted in an atmosphere of friendly participation and interaction among colleagues, recognizing and appreciating the

unique experiences, background, and point of view each student brings. You are expected at all times to apply the highest academic standards to this course and to treat others with dignity and respect.

Accommodating Disabilities (http://www.sa.sc.edu/sds/)

The University of South Carolina provides high-quality services to students with disabilities, and we encourage you to take advantage of them. Students with disabilities needing academic accommodations should register with and provide documentation to the Student Disability Resource Center in Close-Hipp 102 or 803-777-6142, TDD 803-777-6744, email sasds@mailbox.sc.edu. Discuss with the instructor the type of academic or physical accommodations you need.

Writing Center (http://artsandsciences.sc.edu/write/university-writing-center)

No matter what you choose to do after your college career, you can't escape spoken or written communication (emojis won't help you at work). The University Writing Center is an important resource you should use! It's open to help any UofSC student needing assistance with a writing project at any stage of development. The main Writing Center is in Byrnes 703.

University Library Resources (www.sc.edu/libraries)

- University Libraries has access to books, articles, subject specific resources, citation help, and more. If you are not sure where to start, please Ask a Librarian! Assistance is available at www.sc.edu/libraries/ask.
- Remember that if you use anything that is not your own writing or media (quotes from books, articles, interviews, websites, movies – everything) you must cite the source in IEEE format (https://ieeeauthorcenter.ieee.org/wp-content/uploads/IEEE-Reference-Guide.pdf).

Academic Integrity and Responsibility

The University's guidelines for academic integrity are listed in our Honor Code (www.sc.edu/academicintegrity).
You are expected to practice the highest possible standards of academic integrity. As a student of the University of South Carolina, you agree to comply with the University Code of Conduct (www.sc.edu/policies/ppm/staf626.pdf), Honor Code (www.sc.edu/policies/staf625.pdf), Carolinian Creed (www.sc.edu/policies/staf102.pdf), and all Other policies of the University of South Carolina.
Violations of any codes, creeds, rules, or policies will result in referral to the Office of Student Conduct and Academic Integrity. Students found responsible for a violation will recieve an academic grade penalty and non-academic penalties as determined by the Office of Student Conduct and Academic Integrity (www.sc.edu/academicintegrity). You assume full responsibility for the content and integrity of the academic work you submit. The guiding principle of academic integrity shall be that your submitted work, examinations, reports, and projects must be that of your own work. When a student is uncertain as to whether conduct would violate the Honor Code, it is the responsibility of the student to seek clarification from the instructor or the Office of Student Conduct and Academic Integrity www.sc.edu/academicintegrity.

Incomplete Grades

Incomplete grades will be granted only in accordance with university policy. A grade of 'I' (Incomplete) may be assigned if you are unable to complete some portion of the assigned course work because of an unanticipated illness, accident, work-related responsibility, family hardship or verified learning disability. An incomplete grade is not intended to give you additional time to complete course assignments or extra credit unless there is indication that the specified circumstances prevented you from completing course assignments on time.

Day	Date	Topic	Assignment	Due Today
First Day of Class [August 28, 2023]				
1	Aug 28	Introduction to Power Systems	Read Chap 1	
2	Aug 30	Introduction to Power Systems	Read Chap 1	
3	Sep 6	Phasors Review	Read Chap 2.1-2.4	HW#1
4	Sep 11	3-Phase Circuits	Read Chap 2.5-2.7	
5	Sep 13	3-Phase Circuits		HW#2
6	Sep 18	Transformers	Read Chap 3	
7	Sep 20	Transformers	Read Chap 3	HW#3
8	Sep 25	Transformers	Read Chap 3	
9	Sep 27	Per Unit	Read Chap 3	HW#4
10	Oct 2	Examples		
11	Oct 4	Exam 1		
12	Oct 9	Transmission Line Parameters		
13	Oct 11	Transmission Line Parameters		
14	Oct 16	Transmission Line Parameters		
15	Oct 18	Transmission Lines		
16	Oct 23	Transmission Lines, Admittance Matrix		
17	Oct 25	Power Flow Analysis: Intro to Power World		
18	Oct 30	Power Flow Analysis: Gauss		
19	Nov 1	Power Flow Analysis: Gauss-Seidel		
20	Nov 6	Power Flow Analysis: Gauss-Seidel		
21	Nov 8	Examples		
22	Nov 13	Exam 2		

Day	Date	Topic	Assignment	Due Today
23	Nov 15	Power Flow Analysis: Newton Raphson		
24	Nov 20	Power Flow Analysis: Newton Raphson		
25	Nov 22	Thanksgiving Break – No Class		
26	Nov 27	Power Flow Analysis: Newton Raphson		
27	Nov 29	Power Flow Analysis: Newton Raphson		
28	Dec 4	Power Flow Analysis: Newton Raphson		
29	Dec 6	Review		
30	Dec 9	Reading Day		
32				
33	Dec 13	12:30pm, Final Exam, in calss, 2.5 hours		