

ECE 5930/6930 – 3 credits

Fundamentals of Electric Power Systems

COURSE SYLLABUS - Spring 2017

Any change in the syllabus will be announced to students through Canvas.

Lecturer		Asst. Prof. Zeljko Pantic
Email		zeljko.pantic@usu.edu ⁽¹⁾
Phone		435/797-2457 (Innovation Campus office)
Office Location	Main Campus	EL 304C
	Innovation Campus	USTAR Building 620, UPEL Lab , Office 102
Office Hours	M/W	2:30-3:30 (304 C - Main Campus) - Open door policy
	T/Th/F	by appointment (Innovation Campus) ⁽³⁾
Course TA	Reza Tavakoli, PhD Student (reza.tavakoli@aggiemail.usu.edu)	
TA Office Hours	F: 9:00 – 10:00 am (Main Campus) or by appointment (Innovation Campus)	

⁽¹⁾ Email is a preferred communication method. However, consider that email cannot substitute office hour discussion and should be used only to **exchange short and important messages** that cannot wait for lecture time or office hours. Subject of the email should contain "ECE 5930/6930" text.

⁽²⁾ **Canvas** will be used as a prevailing method for course material distribution. USU Canvas website address is: <https://canvas.usu.edu/>

⁽³⁾ Appointment should be made **a day ahead** by sending an e-mail to zeljko.pantic@usu.edu.

COURSE PREREQUISITES

A prerequisite for this course is: **ECE 2250: Electrical Circuits (or equivalent)**

COURSE DESCRIPTION:

Structure of power systems; power system components; three-phase circuits and power flow; analysis of magnetic circuits; single- and three- phase transformers – modeling and analysis; transmission lines modeling; principles of energy and power conversion; modeling and analysis of *dc* motors and generators; modeling and analysis of *ac* synchronous motors and generators.

LEARNING OUTCOMES

- 1) To understand the structure, engineering concepts, and economic aspects of an electric energy system, including energy generation, transmission and distribution, as well as its electromechanical conversion in electric machines.
- 2) To understand the operation of three-phase circuits and systems, and be able to calculate phasor diagrams, active, and reactive powers in the circuit. To understand the operation, regulation principles, and stability limits of synchronous generators, induction machines, distribution transformers, characteristics of transmission lines and other elements frequently applied in electric power systems.
- 3) To be able to develop and interpret mathematical and electric models of an electric power system or its subsystems, considering different levels of details and accuracy.
- 4) To be able to use developed models to analyze the power system, size its components and elements, determine operating constraints, and investigate flow of power on the grid.

COURSE Schedule

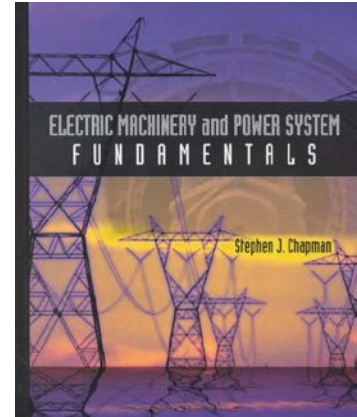
Lectures	Practice Sessions ⁽⁴⁾
Days: M/W	Days: TBA
Time: 3:30 pm – 4:45 pm	Time: TBA
Location: EL 109	Location: TBA

⁽⁴⁾ Not mandatory, **but highly recommended**. Practice sessions will be held once per each homework cycle.

COURSE MATERIAL

Textbook (required):

Chapman, Stephen “*Electric Machinery and Power System Fundamentals*”, McGraw-Hill Science/Engineering/Math, 1st edition, 2001, ISBN: 978-0072291353



It is the responsibility of the students to access the book material. No special accommodation will be provided for those who cannot do that.

Textbooks (recommended):

- Kirtley, James “*Electric Power Principles: Sources, Conversion, Distribution and Use*”, Wiley, 2010, ISBN: 9780470686362

Simulation Software (for graduate students only):

- **MATLAB/Simulink** (student version is sufficient).
Students can access Matlab/Simulink through Open Access Computer labs (<http://it.usu.edu/labs/lab-software/matlab>). It is highly recommendable to use available on-line resources at (<http://www.mathworks.com/>) and get familiar with the software tool.

GRADING

	[%]
Homework	40
Midterm	30
Final Exam	30
Attendance ⁽⁵⁾	0 or 1
Σ	100

⁽⁵⁾ Attendance grading policy – regarding the attendance on Practice Session meetings (there will be total of 10 meetings):

Attendance	Grading
0-6	0 %
7-10	1 %

This course uses standard USU letter grading (percentage will always be rounded to two decimal digits):

% max	100.00	92.99	89.99	86.99	82.99	79.99	76.99	72.99	69.99	66.99	59.99
grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F
% min	93.00	90	87.00	83.00	80.00	77.00	73.00	70.00	67.00	60.00	0

Incomplete grade (“I”) indicates that a student has up to one year to finish the work and it is NOT common practice “unless extenuating circumstances occur in the life of a student”. The university policy on incomplete grades, as well as what might be qualified as extenuating circumstances, is located at <http://catalog.usu.edu/content.php?catoid=3&navoid=421#Incomplete>

EXAMS

Midterm and Final exams will be assigned during the course time. The exams will be problem-solving oriented. At the exams, the **official course textbook and lecture notes will be allowed**. No other textbooks and problem solutions can be used.

HOMEWORK

Homework will be assigned on regular bases. Homework assignments should be submitted **online** through the Canvas online tool. Homework submitted online must be scanned or typed, and submitted as a single pdf document. To be considered for the maximum number of points, homework assignments must be **submitted by** the time specified. Homework assignment submitted after that time, but within the next 24 hours will be qualified as a **late submission**. **Late submission policy:** Except in a case of documented emergency, for any assignment submitted N hours after the deadline, the total number of points will be reduced by $4N$.

However, each student must turn in their own homework. Partial credits will be given for partially correct or unfinished solutions, but that will be **applied very restrictively**.

To be considered for the maximum number of points, the solution of problems should be **neatly written**, and embrace all supporting figures and clarifications that are necessary to understand the idea. **Illegible handwriting** will be returned to the student for correction and resubmission, which will be qualified as a late submission. Make sure that you always circle the final solution or underline concluding statement. Each homework assignment submitted should start with a **title page** that provides general information about the student and the homework. The title page is provided on Canvas. Homework for graduate students will typically **contain one additional problem**. The additional problem is intended to test students' conditional and reflective knowledge through different activities that go beyond typical textbook problems.

LATE ARRIVAL TO CLASS/EXAMINATION

Try to be punctual and arrive to class on time. If you are late for class, enter in the quietest manner possible in order not to interrupt your classmates.

Students who arrive late to the mid/final examination will be permitted to enter and take the exam only if nobody of their classmates has left the classroom before that point. No time extension will be provided for the late-coming students.

ELECTRONIC DEVICES IN THE CLASS

No electronic devices except non-programmable calculators will be allowed during the exam. **No cell phones** are allowed in class. Students **are allowed to use their laptops to take notes**. However, if they decide to do so, they should be seated in the **last row** of the classroom or behind all other students who do not use laptops in class, to provide maximum visibility towards the board.

ACADEMIC INTEGRITY

Academic violations of the Academic Integrity Standard include but are not limited to: **cheating, falsification and plagiarism**. The following text is quoted from the USU Students Code of Conduct:

“Students have a responsibility to promote academic integrity at the University by not participating in or facilitating others' participation in any act of academic dishonesty and by reporting all violations or suspected violations of the Academic Integrity Standard to their instructors. To enhance the learning environment at Utah State University and to develop student academic integrity, each student agrees to the following Honor Pledge: ***“I pledge, on my honor, to conduct myself with the foremost level of academic integrity.”***”

Students are required to be aware and comply with the university policy on academic integrity found in the Code of Student Conduct found at <http://www.usu.edu/student-services/student-code/article6.cfm>

ACCOMMODATIONS

DRC Statement: “Students with ADA-documented physical, sensory, emotional or medical impairments may be eligible for **reasonable accommodations**. Veterans may also be eligible for services. All accommodations are coordinated through the **Disability Resource Center (DRC)** (<https://www.usu.edu/drc/>) (435)797-0359. Please contact the DRC as early in the semester as possible. Alternate format materials (Braille, large print, digital, or audio) are available with advance notice.”

NON-DISCRIMINATION POLICY

The following text is quoted from Student Code of Conduct web page:

<http://www.usu.edu/student-services/student-code/>

“Utah State University is committed to equity in education for its students and that they not be discriminated against/harassed because of **race, color, national origin, religion, sex, age, disability, or veteran status**. In addition, discrimination on the basis of sexual orientation for students in academic programs and activities is prohibited. Student, who feel their rights have been violated, want information, or just need some guidance relating to their course of action relating to Equal Opportunity issues, **should contact the Affirmative Action/Equal Opportunity Office**, located in Old Main, Room 161 or call (435) 797-1266. Information pertaining to other AA/EO-related laws, policies, and issues at the local (USU), state, and federal levels are also available at the office. These items, along with other information, are also available on the AA/EO Office website at: <http://www.usu.edu/aaeo>”

TENTATIVE CLASS SCHEDULE

Class schedule is subject to change. Always **check Canvas** for the latest update of the class schedule, reading assignments, homework due dates, etc. To receive all updates in a timely manner, make sure that your Canvas **Notifications Preferences** are adjusted properly.

Lecture	Date	Topic	Assignment
1-2	Jan-9 Jan-11	Syllabus and Course Overview, Topic 1 - Electric Power System - Introduction	-
3-4	Jan-18 Jan-23	Topic 2 – The Analysis of AC Single-Phase Circuits	HW1
5-6	Jan-25 Jan-30	Topic 3 - Three-Phase Circuit Analysis	HW2
7	Feb-1	Topic 4 - Per-Unit (p.u.) System	
8-9	Feb-6 Feb-8	Topic 5 - Theory and Analysis of Magnetic Circuits	HW3
10-11	Feb-13 Feb-15	Topic 6 - Single-Phase Transformer Modeling and Analysis	HW4
12-13	Feb-21 Feb-22	Topic 7 - Three-Phase Transformer Modeling and Analysis	HW5
14-15	Feb-27 Mar-1	Topic 8 - Transmission Lines	HW6
	Mar-13	Midterm Exam (3:30 pm)	-
16-18	Mar-15 Mar-20 Mar-22	Topic 9 - Principles of Electromechanical Energy Conversion (EMEC) – Part I	HW7
19-22	Mar-27 Mar-29 Apr-3 Apr-5	Topic 10 - Principles of Electromechanical Energy Conversion (EMEC) – Part II	HW8
23-25	Apr-10 Apr-12 Apr-17	Topic 11 - DC Machines	HW9
26-28	Apr-19 Apr-24 Apr-26	Topic 12 - Synchronous Machines	HW10
		Final Exam (05/03/2017, 3:30 pm)	