

## **ECE 523: Symmetrical Components**

### **Fall 2009**

<b>DESCRIPTION</b>	Concepts of symmetrical components, sequence impedances of devices and lines, circuit equivalents for unbalanced faults, management during faults.
<b>PREREQUISITES</b>	Power Systems Analysis (UI ECE422 or equivalent) or instructor's permission.
<b>INSTRUCTOR</b>	Brian K. Johnson
<b>CLASS TIME</b>	3:30-4:20am MWF, JEB 21
<b>CONTACT INFO</b>	Phone: 208-885-6902 (800-824-2889, ext. 6902) Fax: 208-885-6165 e-mail: <a href="mailto:bjohnson@uidaho.edu">bjohnson@uidaho.edu</a> or <a href="mailto:b.k.johnson@ieee.org">b.k.johnson@ieee.org</a>
<b>OFFICE HOURS</b>	M, W 10:30am -11:30am (all times are Pacific time) T, Th 11:00am-12:00pm F 11:30am -12:30pm or anytime my door is open
<b>COURSE WEB SITE</b>	<a href="http://www.ece.uidaho.edu/ee/power/ECE523/">http://www.ece.uidaho.edu/ee/power/ECE523/</a>
<b>TEXT</b>	<i>Required: Nasser Tleis, Power Systems Modelling and Fault Analysis: Theory and Practice. Newnes Power Engineering Series. 2008</i>
<b>REFERENCES</b>	1. P.M. Anderson, <i>Analysis of Faulted Power Systems</i> , Wiley-IEEE Press 1995 2. J. L. Blackburn, <i>Symmetrical Components for Power Systems Engineering</i> . CRC Press. 1993
<b>SOFTWARE</b>	You will be required to use MathCAD for several projects during this course.  You can order the latest version of the student edition of MathCAD for a reduced price through the University of Idaho Department of Civil Engineering (208-885-6782) say you are in a UI Engineering Course.

#### **GRADING:**

<b>Item</b>	<b>Percent of Grade</b>	<b>A: 90-100</b>
Homework/Labs	50%	B: 80-89
Exam 1	25%	C: 70-79
Final Exam	25%	D: 60-69
		F: < 60

## COURSE OUTLINE

Topic	Approx. Number of Lecturers	Book Chapter
1. Introduction/welcome and review of fundamentals a. Transient versus quasi-steady-state b. Per unit analysis c. Mutual coupling between different voltage levels in per unit analysis	1.5	Chapter 1  Section 1.5 Section 1.7 Section 1.8 **
2. Symmetrical components theory	2.5	Chapter 2, notes
3. Basic fault analysis a. Shunt faults b. Series faults c. Simultaneous faults	4	Chapter 2
4. Including loads and load flow in fault analysis	2	Notes, Sections 4.6 and 4.7
5. Power Apparatus Modeling a. Modeling overhead transmission lines b. Modeling underground cables c. Modeling transformers and reactors Midterm exam: Approximately October 16 d. Modeling series and shunt capacitors e. Modeling of synchronous machines f. Modeling of induction machines g. Modeling of power electronic devices	7 3 3 1 4 3 2	Chapter 3 Chapter 3 Chapter 4  Chapter 4 Chapter 5 Chapter 5 Notes, section 4.5
6. Analysis techniques and tools	5	Notes, Chapter 6
7. Network Equivalent	1	Chapter 8
8. Application of standards	2	Chapter 7
9. Methods for limiting fault current levels	2	Chapter 9
10. Grounding methods and impacts (if time)	1	Chapter 10

1. Exams may given as “take homes”
2. Note: homework assignments and projects will require software tools, especially MathCAD.

**LECTURE DATES:**

Monday Date	Monday	Wednesday	Friday
August 24	1	2	3
31	4	5	6
September 7	H	7	8
14	9	10	11
21	12	13	14
28	15	16	17
October 5	18	19	20
12	21	22	23
19	24	25	26
26	27	28	29
November 2	30	31	32
9	33	34	34
16	36	37	38
23	H	H	H
30	39	40	41
December 7	42	43	44

Final Exam: Monday December 14, 3:00pm – 5:00pm (might be replaced by a take-home exam/project).

## **GENERAL GUIDELINES:**

### **On-Campus Students:**

1. Homeworks handed in after the due date will be worth a maximum of 50%. However, I will allow extensions if you consult with me in advance and if you have a major schedule conflict
2. Feel free to contact me by phone or e-mail if you have questions and can't make it to my office easily.
3. We will be scheduling lab sessions using the model power system outside of the normal class time. We will try to set times that don't cause problems with your work schedules or the schedules for your other classes.

### **Outreach Students:**

1. This is not a self-paced class. Engineering Outreach students are expected to finish within two weeks of the on-campus students.
2. Due dates for homework and projects will generally be specified two weeks later than the due date for on-campus students. This is the date when your assignment reaches Moscow. Assignments will be worth a maximum of 50% after the due date, and prior to the due date plus one week. However, I will allow extensions if you consult with me in advance and if you have a major schedule conflict.
3. Returned homework and projects may not reach you prior to exams. Please make copies of any assignments that you believe may be useful before you submit them.
4. Please put your name and the course number on top of the first page of each exam and homework, especially if submitting by FAX. E-mail submission of assignments is ok, as long as compatible file formats are used.

Allowable formats for electronic submission are Adobe Portable Document Format (PDF), Microsoft Word (\*.doc), Rich Text Format (\*.rtf) or MathCAD 14 (or earlier). Limit to one or two attached files. I do not want a large number of files with no documentation on what order to use them.

5. Make sure you number your pages as: 1/4, 2/4, etc., especially if you sending a FAX, so I know whether or not I have a complete set. Also make sure writing is dark and clear on the FAX.
6. Phone calls or the use of e-mail for asking questions is encouraged. You are welcome to call outside of office hours. The Engineering Outreach 800 line is available 24 hours a day so you can reach me outside of their hours.