

ECE 525: Power Systems Protection and Relaying

Summer 2023 (recorded fall 2018)

DESCRIPTION	Study of power system faults and application of relays for power system protection. Review of symmetrical components as applied fault currents. Introduction to digital filtering and microprocessor-based relaying. Use computer simulation for application of relays.
PREREQUISITES	Power Systems Analysis (UI ECE 422 or equivalent) or permission.
INSTRUCTOR	Brian K. Johnson
CONTACT INFO	Phone: 208-885-6902 (800-824-2889, ext. 6902) Fax: 208-885-6165 e-mail: bjohnson@uidaho.edu
OFFICE HOURS	Zoom or phone office hours available on request.
COURSE WEB SITE	https://webpages.uidaho.edu/ECE/EE/power/ECE525/
TEXT	<p><i>Three options for main textbook:</i></p> <ol style="list-style-type: none">(1) P. M. Anderson, C. Henville, R. Rifaat, B. Johnson, S. Meliopoulos: <i>Power System Protection, 2nd Edition</i>, Wiley, 2022. (likely to be used for ECE 526)(2) J.C. Das: <i>Power System Protective Relaying</i>. CRC Press, 2017(3) J.L. Blackburn and T.J. Domin: <i>Protective Relaying: Principles and Applications, Fourth Edition</i>. CRC Press, 2014 (3rd edition of the book is ok as well). <p>We will also refer to: GE Grid Solutions Network Protection and Automation Guide (available for free on the web, see links on course web page for access instructions).</p>
REFERENCES	<ol style="list-style-type: none">1. H.J. Altuve, E. O Schweitzer, III, <i>Modern Solutions for Protection, Control and Monitoring of Electric Power Systems</i>. Schweitzer Engineering Laboratories, Inc., 2010. Order through SEL: http://www.selinc.com2. P.M. Anderson, <i>Analysis of Faulted Power Systems</i>, IEEE PRESS, 2000. Note: this book is available for free download for IEEE members from IEEEXplore (log in as yourself, go to Books, then select tab for Classics and search for the book title) and through UI library.3. P.M. Anderson, <i>Power System Protection</i>. IEEE PRESS, 1998. Note: this book is also available for free download for IEEE members from IEEEXplore as well as through UI library.
SOFTWARE	<ul style="list-style-type: none">• You will be required to use MathCAD for several projects during this course. I can provide you a link for ordering a student license at a reduced fee under a UI license. You can also access it through the university VLAB.• You might want to use a commercial fault program for performing short calculations at times. If you do not have access to a program, you can use the demo/educational version of Powerworld: http://www.powerworld.com• I will do some relaying examples using relay models in transients programs. We will discuss access to those programs.

GRADING:

Item	Percent of Grade	A: 90-100
Homework	23%	B: 80-89
Labs/Projects	16%	C: 70-79
Quizzes	5%	D: 60-69
Exam 1	28%	F: < 60
Final Exam	28%	

COURSE OUTLINE

<i>Lecture Topic</i>
Introduction/Welcome
Protection Basics
Instrument Transformers
Grounding schemes, fault detection and identification
Brief Review of Symmetrical Components
Distribution Protection <ul style="list-style-type: none"> • Instantaneous overcurrent protection • Time overcurrent protection • Directional protection • Coordination • Arc flash
Fundamentals for software tools and labs <ul style="list-style-type: none"> • Introduction to transient simulation tools • Introduction to MathCAD • Signal processing and digital filtering –in MathCAD • Distribution Relay in MathCAD • Introduction to AMPS • Lab 1/project 1: • Lab 2/project 2:
Bus protection <ul style="list-style-type: none"> • Differential Protection • Bus configurations • Common bus protection schemes • Impacts of CT saturation • Lab 3/project 3:
Reactor/Capacitor Bank Protection
Transformer Protection <ul style="list-style-type: none"> • Lab 4/project 4

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

GENERAL GUIDELINES:

Outreach Students:

1. This is not a self-paced class. Engineering Outreach students are expected to finish the course at the same time as the on-campus students.
2. Due dates for homework and projects will generally be specified the same as 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. However, we will allow extensions if you consult with us in advance and if you have a major schedule conflict.
3. Please include "ECE 525" in the subject line of e-mail correspondence related to this course.
4. 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.
5. Please put your name and the course number on top of the first page of each exam and homework, especially if submitting e-mail or fax. It would be best if your name was in the header of each page. 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 or *.docx), Rich Text Format (*.rtf) or MathCAD 15 (or earlier) or Prime 8.0. Limit to one or two attached files. I don't want a large number of files with no documentation on what order to use them.

6. Please do not send copies of homework submissions to the TA from Fall 2018. Instead copy **Mataz Alanzi** (alan5214@vandals.uidaho.edu).
7. Make sure you number your pages as: 1/4, 2/4, etc., so I know whether or not I have a complete set. Also make sure writing is dark and clear on the scan.
8. 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 us outside of their hours.
9. Library Resources: As a UI student, you not only have access to valuable print and electronic resources from the university's library, such as access to IEEEExplore, but you also have the access to personalized assistance from the librarians. If you have assignments or research questions and aren't sure how to make the most of library resources from off campus, you can visit the Off-Campus Access information page on the library's website at: <http://www.lib.uidaho.edu/help/offcampus.html>

As a UI student you can also download a VPN client from the ITS Help Desk:
<https://support.uidaho.edu/TDClient/KB/ArticleDet?ID=231>

You will need to log in using your UI student account.