WASHINGTON STATE UNIVERSITY

EE511 Protection of Power Systems II

EECS
Washington State University

COURSE SYLLABUS

Instructor:	Saeed Lotfifard	Term:	Fall 2023
Office:	EME 45	Class Meeting Days:	Tuesday, Thursday
Phone:	(509) 335-0903	Class Meeting Hours:	12:05-1.20 PM
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Instroctor's webpage	http://eecs.wsu.edu/~lotfi/		

Office hour: 10:30-11:30 am

I. Course Overview
This course introduces students to timely topics on power systems protection. It provides a comprehensive understanding of different aspects of modern protective relays and protection schemes. The course starts with measurement chain, both hardware and firmware, of Intelligent Electronic Devices (IEDs). The course will then focus on theory and implementation of digital protective algorithms in electric power systems. Different algorithms and schemes for component protection and system wide protection of power systems will be detailed.

II. Course Objectives
Having taken this course students will (i) be familiar with the measurement procedure in IEDs, (ii) be introduced to digital algorithms for analysis of power systems, with special focus on protection applications, (iii), be familiar with component and system wide protection of power systems and (iv) understand time domain and phasor domain analysis of events in power systems

III. Course Credits
3 credits

IV. Required Texts and Materials
- T. Johns, S. K. Salman "Digital Protection for Power Systems" IET, 1997
- Instructor's notes.

V. Grading Policies

Assessment	Percent of Final Grade
Test#1	20%
Test#2	20%
Homework	15%
Project (Final presentation and a final report)	45%
	100%

Grading Scale (%)	
90-100	A
85 - 89	B+
80-84	B
75 – 79	C+
70-74	C
65 - 69	D+
60-64	D
0 - 59	F

VI. Course Policies

- Tests are closed book
- No late homework will be accepted
- Up to 10% extra credit is considered for the projects qualified for submission to professional conferences/ journals.
- The project can be done individually or in group of two people (individual contribution must be stated clearly)
- This course follows EECS academic integrity policy posted at
  http://www.eecs.wsu.edu/~schneidj/Misc/academic-integrity.html
- The policy related to Students with Disabilities are posted at
  http://accesscenter.wsu.edu/

Course Topics and Tentative Calendar

Week#	Course Topics
1	• Introduction, Course Outline, Definitions • IED's Hardware
2	• Phasor Estimation, Short-window Algorithm(Mann& Morrison Algorithm, Prodar Algorithm)
3	• Phasor Estimation, Long-window Algorithm (Fourier Algorithm, Least Squares Algorithm, Kalman Filtering)
4	• Phasor Estimation, Long-window Algorithm (Fourier Algorithm, Least Squares Algorithm, Kalman Filtering)
5	• Differential equation based protection
6	• Traveling wave based protection (time domain transient analysis of power systems)

7	• Traveling wave based protection (time domain transient analysis of power systems)
8	• Traveling wave based protection (protective schemes)
9	• Summary and Test #1
10	• Digital transformer protection
11	• Directional overcurrent relay
12	• Distance relay
13	• Generator protection
14	• Wide area protection
15	• Wide area protection
16	• Project Presentations and summary

**VII. Topics [with corresponding ABET outcomes
(http://school.eecs.wsu.edu/undergraduate/ABET)**

- IED's Hardware [a, b, e]
- Phasor Estimation, Short-window Algorithm [a, e]
- Phasor Estimation, Long-window Algorithm [a, e]
- Differential equation based protection [a, e]
- Traveling wave based protection (time domain transient analysis of power systems) [a, e]
- Digital transformer protection [a, e, j]
- Digital line protection [a, e, j]
- Wide area protection [a, e,j]