

## Course Syllabus and Schedule

EE 582.02 - Spring 2020

### Student Learning Outcomes and Assessment

Student Learning Outcomes	Course topics, Activities/Dates	Evaluation of Outcome:
Understanding of unbalanced three-phase analysis for distribution systems	Lectures on week 1-5	Homework assignments and mid-term exam
Ability to analyze common power quality phenomena	Lectures weeks 3-9	Homework assignment and mid-term exam
Ability to design solutions to mitigate power quality impacts	Lectures 11-13	Homework assignment and final exam
Understand emerging challenges in distribution grid power quality issues	Lecture 14-16	Course project

### Expectations for Student Effort

Students should expect a minimum of 6 hours per week of work outside the class.

### Tentative Schedule

Week	Topics Covered	Assignments
1	Introduction, definitions, course material	
	Classification of PQ phenomenon	
2	PQ problems due to fault, fault clearing practices, fuse recloser coordination	
	Voltage sag analysis – Thevenin equivalent circuit, SLG fault, 3LG fault	
3	Voltage swell phenomenon	
	Guest Lecture	HW 1 due
4	Voltage sag due to IM starting	
	Transient overvoltage phenomenon – Application of shunt capacitor banks, steady-state voltage rise, power factor correction	
5	Isolated capacitor switching, Back-to-back capacitor switching, voltage magnification	
	Capacitor restrike transients, methods to manage capacitor switching	HW 2 due
6	Managing capacitor switching, designing inrush and outrush current limiting reactor	

	Ferroresonance and course project discussions	
7	Power system harmonics – cause of harmonic distortion (linear and non-linear loads), Fourier analysis	
	PQ quantities under non-sinusoidal condition, Sources of power system harmonics	HW 3 due
8	Modeling Power system components under non-sinusoidal condition	Course Project Proposal due
	Effects of harmonics on Power system, Effect on capacitor and transformer	
9	Harmonic analysis – setting limit, system response characteristics (Impedance Scan)	
	Harmonic analysis – setting limit, system response characteristics (Impedance Scan)	HW 4 due
10	Spring break	
11	Harmonic power flow	
	Methods to control harmonics	
12	Filter Design	
	Guest Lecture	HW 5 due
13	Power Quality issues due to inverter-connected DERs in distribution systems	
	Integration DERs in power distribution systems, IEEE 1547 standard	
14	Mitigation of PQ issues due to DERs in distribution systems	
	Introduction to Islanded Microgrids	HW 6 due
15	Power Quality issues in Islanded Systems	
	Unbalance and Harmonics mitigation in Microgrids	
16 (last class week)	Course Project Presentations	
Final Exam week	Project Report Due	

### Description of Required Assignments:

1. Homework will be assigned biweekly. The instructor will upload solutions to the blackboard for selected problems.
2. Assignment will include numerical problems and computer simulations to verify the numerical solutions. Students will be required to prepare a brief report on their analysis on simulation results. There will be a total of 7 homework assignments.
3. The course also includes a course project. A possible set of course project will be provided by the instructor. The students can also select their own topic for the project; however instructor will judge the suitability of the topic and can assign another problem if necessary. The project will include literature review, simulations, analytical discussions, report writing and a final presentation.

### Grading Policy

Activity	Percentage grade
Mid-term Exam 1	25%
Mid-term Exam 2	25%
Homework	25%
Class Project	20%
Class participation	5%

Score	Letter Grade
93-100	A
90-92	A-
85-89	B+
80-84	B

Score	Letter Grade
75-79	B-
72-74	C+
70-71	C
67-69	C-

Score	Letter Grade
63-66	D+
60-62	D
<60	F
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**Note:** Final grades will be rounded to closest possible letter grade. For example, 89.5 will be rounded to 90 and will be assigned an A- letter grade.

**Note:** Late assignments will not be accepted. The student will not receive a grade on any assignment submitted past deadline. A late submission will be accepted only for advanced noticed WSU-approved official university activities.

A make-up exam will not be scheduled without an official and documented reason in advanced and as specified by the university policy and recommended guidelines.

**Attendance Policy:**

A 5% grade is allotted for class attendance. For every absence without permission, the student's final numerical average will be reduced by 1%, up to a maximum reduction of 5%.

**WSU Reasonable Accommodation Statement**

Students with Disabilities: Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center [Pullman] or Disability Services at [name of campus] address on your campus] to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center or Disability Services. For more information contact a Disability Specialist on your home campus.

Pullman or WSU Online: 509-335-3417, Washington Building 217; <http://accesscenter.wsu.edu>, [Access.Center@wsu.edu](mailto:Access.Center@wsu.edu)

Tri-Cities: <http://www.tricity.wsu.edu/disability/>

**WSU Academic Integrity Statement**

Academic integrity is the cornerstone of higher education. As such, all members of the university community share responsibility for maintaining and promoting the principles of integrity in all activities, including academic integrity and honest scholarship. Academic integrity will be strongly enforced in this course. Students who violate WSU's Academic Integrity Policy (identified in Washington Administrative Code (WAC) 504-26-010(3) and -404) will receive fail the assignment/exam, will not have the option to withdraw from the course pending an appeal, and will be reported to the Office of Student Conduct.

Cheating includes, but is not limited to, plagiarism and unauthorized collaboration as defined in the Standards of Conduct for Students, WAC 504-26-010(3). You need to read and understand all of the definitions of cheating: <http://app.leg.wa.gov/WAC/default.aspx?cite=504-26-010>. If you have any questions about what is and is not allowed in this course, you should ask course instructors before proceeding. If you wish to appeal a faculty member's decision relating to academic integrity, please use the form available at [conduct.wsu.edu](http://conduct.wsu.edu).

**Classroom Safety Statement**

Classroom and campus safety are of paramount importance at Washington State University and are the shared responsibility of the entire campus population. WSU urges students to follow the "Alert, Assess, Act," protocol for all types of emergencies and the "Run, Hide, Fight" response for an active shooter incident. Remain ALERT (through direct observation or emergency notification), ASSESS your specific situation, and ACT in the most appropriate way to assure your own safety (and the safety of others if you are able). Please sign up for emergency alerts on your account at MyWSU. For more information on this subject, campus safety, and related topics, please view the FBI's Run, Hide, Fight video and visit the WSU safety portal.

