

Dordt College Engineering Department

EGR 360, Introduction to Power System Analysis

Fall 2015 Syllabus

2015-16 Catalog Data:	EGR 360 Introduction to Power System Analysis (4 credit hours) (Fall, Odd)
	An introduction to the design, planning and operation of electric power utilities, including principles of economic dispatch and politics which impact design and operation strategies. Topics include power transmission lines, transformers, generators, system modeling, load flow analysis, faults, and system stability. Prerequisites: Engineering 220; Mathematics 201.
Course application	This course is required for certain students in the engineering major. See the Catalog for details.
Prerequisites by topic:	1.) Linear Circuit Analysis 2.) Differential Equations, Laplace Transforms 3.) Multivariable Calculus
Required Textbooks:	Ned Mohan, <i>Electric Power Systems: A First Course</i> , Wiley, 2012. ISBN 978-1-118-07479-4 (Main textbook) Alexander and Sadiku, <i>Fundamentals of Electric Circuits</i> , 4th ed., McGraw-Hill, 2009 ISBN 978-0-07-352955-4. (covering Chapters 11 and 12 on AC power)
References:	Fred I. Denny and David E. Dismukes, <i>Power system operations and electricity markets</i> , CRC Press, 2002. ISBN 0-84-930813-5 Olle I. Elgerd, <i>Electric Energy Systems Theory, An Introduction</i> , 2nd Edition, McGraw-Hill, 1982. ISBN 0-07-019230-8 John J. Grainger and William D. Stevenson, <i>Power System Analysis</i> , McGraw Hill, 1994. ISBN 0-07-061293-5 Hadi Saadat, <i>Power System Analysis</i> , 2 nd Edition, McGraw Hill, 2002. MHID 0-07-284869-4, ISBN 978-0-07-284796-3
Instructor:	Douglas De Boer, Professor of Engineering, ddeboer@dordt.edu, telephone 712-722-6245. Office hours generally 8:30 to 5:00 PM weekdays. Details at http://homepages.dordt.edu/ddeboer/
Methods of Instruction	Three lectures per week. Mondays 8:00 – 8:50 am, Tuesdays 8:00 – 9:15 am, Thursdays 8:00 – 9:15 am in room SB2803. Weekly homework assignments. One homework assignment will be a computer project and will be graded separately from the other homework. Two tests during the semester and a final exam.
Course Objectives and Outcomes:	<i>Creational Structure:</i> Students will be able to analyse typical power systems circuits containing perhaps a half-dozen busses. The result of such an analysis will typically be the power flow (real and reactive) through a transmission line, voltage and current levels, and required ratings for equipment. These analyses will emphasize balanced three-phase systems, load flow, and economic dispatch. In order to do such an analysis the students will have to know the basic laws of nature for electric power systems. <i>Creational Development and Contemporary Response:</i> , Students will write a research paper organized around a thesis statement on a topic related to the regulation and/or related politics of power systems operations or a technical aspect of the planning for, design of, or operation of power systems.
Computer use:	The primary software used for this course is the Evaluation/Education version of the Power World Simulator from Power World Corporation and Matlab with the Power Systems Toolbox that accompanies the textbook. Students are encouraged (but not required) to use programs such as Mathcad or Matlab for homework solutions when appropriate.
Canvas@dordt	Assignments and handouts will be made available via Dordt's course management system, "Canvas@dordt." The logon URL is http://dordt.instructure.com . Use your Dordt College network user ID and password. Then drill down to the EGR 360 course.
Accommodations	Students who require assistance or accommodations based on the impact of a disability must contact the Coordinator of Services for Students with Disabilities, Marliiss Van Der Zwaag, to access accommodations. Telephone 722-6490, e-mail Marliiss.VanDerZwaag@Dordt.edu.
Means of Evaluation:	Homework (10%), Two Tests (28% each), Computer Project (6 %), Final Exam (28%). Grades are reported using points and grade points. A = ~4, B = ~3, etc. For more detail see http://homepages.dordt.edu/ddeboer/F15/GDS.HTM .

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Dates			Class
			Part I Introduction,
8/25	8/27		Overview of the U.S. power grid and its management., <i>Mohan's Text: Chapter 1</i> Review of Phasors, <i>Alexander & Sakiku's Text—Ch. 9 Sec. 1-5</i> or <i>Dorf & Svoboda's Text: Ch. 10 Sec. 1-8, 12</i>
			Part II Basics
8/31	9/1	9/3	AC Steady State Power, <i>Alexander & Sakiku's Text—Ch. 11 Sec. 2, 4, 6</i> or <i>Dorf & Svoboda's Text: Ch. 11 Sec. 1-5</i>
9/7	9/8	9/10	AC Steady State Power, <i>Alexander & Sakiku's Text—Ch. 11 Sec. 3, 5, 7, 8</i> or <i>Dorf & Svoboda's Text: Chapter 11 Sections 6 – 8</i>
9/14	9/15	9/17	AC Steady State Power, <i>Mohan's Text: Chapter 2 Sections 1 – 3</i>
9/21	9/22	9/24	Three-Phase Power, <i>Alexander & Sakiku's Text—Ch. 12</i> or <i>Dorf & Svoboda's Text: Chapter 12</i>
9/28	9/29		Three-Phase Power (continued from previous week)
(no class 10/1) Tu, 9/29 Test			
10/5	10/6	10/8	One-Line Diagrams, Per-Unit Measures, Per Phase Analysis, <i>Mohan's Text: Chapter 2 Sections 4 – 8</i>
			Part III Elements of Power Systems
10/12	10/13	10/15	The Environment and Prime Sources of Energy <i>Mohan's Text: Chapter 3</i>
10/19	10/20	10/22	Transmission Lines <i>Mohan's Text: Chapter 4</i>
10/26	10/27	10/29	Transformers, <i>Mohan's Text: Chapter 6 and Alexander & Sakiku's Text—Ch. 13</i> or <i>Dorf & Svoboda's Text: Ch. 11 Sec. 9, 10</i>
11/2	11/3	11/5	High Voltage DC transmission <i>Mohan's Text: Chapter 7</i>
11/9	11/10	11/12	Synchronous Generators <i>Mohan's Text: Chapter 9</i>
			Part IV Operation and Control of Power Systems
11/16	11/17	11/19	Power Flow Analysis <i>Mohan's Text: Chapter 5</i>
11/23	11/24		Voltage Regulation and Stability <i>Mohan's Text: Chapter 10</i>
(no class 11/26) Tu, 11/24 Test			
12/1	12/3		Voltage Regulation and Stability <i>Mohan's Text: Chapter 10</i>
(no class 11/30)			
12/7	12/9	12/10	Optimal Dispatch Stability of Power Systems and Protection from Faults <i>Mohan's Text: Chapters 11, 12, 13 as time allows</i>
(no class Fri., 12/13)			
Monday, 12/14			Final exam, 3:30 p.m – 5:30 p.m.

Note: Schedule may vary by up to two weeks in order to best adapt it to our needs.

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The information on this and the following page is mostly copied from the Student Handbook as per policy in Dordt College's "Syllabus Checklist." *There is some additional information specific to this course as well. Additional information is in italic face.*

Academic Integrity

Dordt College is committed to developing a community of Christian scholars where all members accept the responsibility of practicing personal and academic integrity in obedience to biblical teaching. For students, this means not lying, cheating, or stealing others' work to gain academic advantage; it also means opposing academic dishonesty.

Academic Dishonesty. Students found to be academically dishonest will receive academic sanctions from their professor (from a failing grade on the particular academic task to a failing grade in the course), who will report the incident and the sanction given to the Student Life Committee for possible institutional sanctions (from a warning to dismissal from the college).

Appeals in such matters will be handled by the student disciplinary process as outlined in the Student Handbook.

Definitions

Academic dishonesty at Dordt College includes, but is not limited to, the following behaviors:

Stealing/Plagiarizing: copying another's work or ideas and creating the impression that they are one's own by failing to give proper credit or citation. This includes reading or hearing another's work or ideas and using them as one's own; quoting, paraphrasing, or condensing another's work without giving proper credit; purchasing or receiving another's work and using, handling, or submitting it as one's own work.

Cheating: unauthorized use of any study aids, equipment, or another's work during an academic task. This includes using unauthorized aids or other equipment during an examination; copying or looking at another individual's examination; taking or passing information to another individual during or after an examination; taking an examination for another individual; allowing another individual to take one's examination; stealing examinations.

All graded academic tasks are expected to be performed on an individual basis unless otherwise stated by the instructor.

An academic task may not be submitted by a student for course credit in more than one course without the permission of all instructors.

Lying/Fabricating: the intentional, unauthorized falsification or invention of any information or citation during an academic task. This includes changing or adding an answer on an examination and resubmitting it to change the grade; inventing data for a laboratory exercise or report.

Facilitating Academic Dishonesty: knowingly allowing or helping another individual to plagiarize, cheat, or fabricate information.

Students must do their own work. In Prof. De Boer's courses students may verbally discuss homework but may not show un-graded papers to each other. Detail on this policy can be found on the web at <http://homepages.dordt.edu/ddeboer/F15/HWSTDF15.HTM#DYOW> This policy applies to the whole course, not just homework.

Attendance

Students are expected to be present for every class and laboratory period. Penalties for absence from class are left to the instructor. No designated number of skips is permitted.

Student Responsibility: Students shall notify each professor concerning the reason for absence prior to or immediately upon returning to class or in accordance with the instructor's method of accounting for absences. Students shall notify student services concerning all illnesses.

Unexcused absences are defined as failing to notify the instructor of the reason for the absence, or if the instructor deems the reason as illegitimate.

Faculty initiatives: The instructor may contact student services to check on the illness record of the students. They should also alert student services and contact the student directly concerning excessive absences, and must, if asked, report attendance patterns. Any instructor may, after due

warning and according to guidelines established in the class syllabus, penalize the student by reducing the semester grade by a given percentage.

Student Services Responsibility: Normally, student services does not notify instructors concerning student illness. Student services may alert instructors to serious problems. Decisions to inform instructors about serious problems will be made balancing the need to respect confidentiality and the responsibility to keep instructors appropriately informed about their students. Any student with serious problems is strongly advised to work closely with student services and follow the process to insure adequate communication between all parties in as efficient a way as possible.

Excused Absence for Activities: Students have obligations in many realms, so special care shall be taken not to demand commitments for participation in extra-curricular events that cause neglect in other areas. Sponsors/coaches shall inform students from the beginning of the time and effort expected of them. Sponsors/coaches shall demand a minimum of absences from other classes, restrict student involvement to only those crucially involved, and make efforts to choose a time/date for the event that is least invasive of classroom or lab time. In the case of conflicts, resolution shall be the responsibility of the sponsor/coach and the instructor with no penalty to the student (The appeals process outlined in the section titled Complaints Regarding Instruction in the Student Handbook shall be used if needed). The sponsor shall email faculty and student services a list of names, dates, and activities in advance of the event. The student must contact the instructor and make arrangements for any missed work.

Professor De Boer expects to be notified at least a day in advance if you can reasonably be expected to have known that far in advance of a time when you will have to miss a class for a scheduled event of higher priority. In addition to the options listed above, missing classes without notification or for insubstantial reasons could be cause for being classified as an, "uncooperative student" which could lead to dismissal from the course. Professor De Boer will give one warning before invoking the uncooperative student process.

Late work

Anything handed in late will be accepted for possible grading, but usually no grade will be entered in the grade book, the work will not be returned to you, and the empty grade will function as a zero or an "F." Usually the item will never be graded. If, in the judgment of Prof. De Boer, grading the late item might improve the course grade, and if the reasons for the late work seem acceptable and if there is no pattern of carelessness, then Prof. De Boer may choose to estimate a grade or actually grade the late work and replace the empty grades in the grade book with the estimates or actual grade(s). Prof. De Boer may make a decision to estimate or fully grade a late item at any time after the item is handed in, but usually will do so only at the end of the course after all student course activities are complete. Additionally, if a pattern of late work develops, the professor will warn the student. After that warning if the problem is not resolved, a reduced course grade might result and/or the student may be classified as "uncooperative" which could lead to dismissal from the course.

Missed Tests or Exams

Professor De Boer announces his test schedule in the first week of classes. During the first two or three weeks of classes and possibly at other times, if there is good cause, students may negotiate to change the test date(s) for the entire class to avoid a conflict for any one student. However in the week before a test Prof. De Boer is very reluctant to negotiate the date because this can cause hardship for those who have been carefully planning. If you realize that you have a schedule conflict with a test date, discuss this with Prof. De Boer as soon as possible. If your reasons are sound, Prof. De Boer may schedule a special test time just for you. This special test time will usually be in advance of the regular test date.

If you are late to a test you must still finish at the scheduled time.

If you miss a test entirely the test will go in the grade book as a blank score which will count as an "F." At the end of the semester after all your course work is complete Prof. De Boer will reassess the situation and might choose to estimate what he thinks you might have earned on the test based on any evidence he can find relevant to the situation. If an estimated grade is granted, it may still be discounted to a lower grade than the other tests and exams you completed if negligence is a partial cause for missing the exam. A dead cell phone battery that causes you to miss an alarm is an example of negligence. If a test is missed due to illness (fever, nausea, etc., not just a "bad cold") then be sure to report the illness to student services before the test or during the test period. If student services can verify your illness to Prof. De Boer, an estimated grade that is non-punitive will be given.

Class Participation

Professor De Boer does not grade class participation—it is expected of all students. If this is a problem Prof. De Boer will talk about it privately with you. Usually mere attendance is adequate participation, presuming you are not sleeping in class or hung over. If you are sleeping in class or hung over you will be considered absent on those days and the attendance policy will apply.