Western Engineering

Western University
Faculty of Engineering
Electrical and Computer Engineering Program

ECE 4464A – Electric Power Systems II

Course Outline Fall 2025

COURSE DESCRIPTION: This course aims to provide the students with theoretical and practical knowledge on electric power system analysis and design. The topics covered in the course have significant applications in many areas including power system operation, protection, control, and stability.

ACADEMIC CALENDAR:
https://westerncalendar.uwo.ca/Courses.cfm?CourseAcadCalendarID=MAIN_015120_1&SelectedCalendar=Live&ArchiveID=

Power flow studies; symmetrical faults; symmetrical components; unsymmetrical faults; power system stability; Introduction to High Voltage DC (HVDC) Transmission and Flexible AC Transmission Systems (FACTS).

PRE OR COREQUISITES: ECE3333A/B

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record.

ANTIREQUISITES: None

CEAB ACADEMIC UNITS: Engineering Science 100%, Engineering Design 0%.

CONTACT HOURS:

Lectures occur weekly. Laboratory sessions occur weekly.

LECTURE:	3 lecture hours per week
LAB:	0.5 laboratory hours per week (three 3-hour lab sessions per term)
TUTORIAL:	1 tutorial hour per week (twelve 1-hour sessions per term)

RECOMMENDED/REQUIRED TEXT:

Power System Analysis and Design, SI Edition | 7th Edition
Authors: J. Duncan Glover/Mulukutla S. Sarma/Thomas Overbye/Adam Birchfield
Publisher: Cengage
ISBN: 9780357676196
Cost: $198.95

The sixth (SI) edition of the book is also acceptable.

RECOMMENDED/ REQUIRED SOFTWARE:

PowerWorld Simulator software (open source)

RECOMMENDED RESOURCES/REFERENCES:

1) *Smart Solar PV Inverters with Advanced Grid Support Functionalities*
   Author: Rajiv K. Varma
   Publisher: Wiley - IEEE Press, USA, Dec. 2021, 512 pages, ISBN: 978-1-119-21418-2

2) *Power System Analysis*
   Authors: John. J Grainger and William. D. Stevenson, Jr.,
   McGraw Hill, New York, 1994.
   Taylor Library, Call number: TK3001.G73 1994.

GENERAL LEARNING OBJECTIVES (CEAB GRADUATE ATTRIBUTES)

Knowledge Base	A	Engineering Tools	A	Impact on Society	
Problem Analysis	A	Individual & Teamwork		Ethics and Equity	
Investigation		Communication		Economics and Project Mgmt.	
Design		Professionalism	D	Life-Long Learning	D

Notation: x represents the content level code as defined by the CEAB. blank = not applicable; I = introduced (introductory); D = developed (intermediate) and A = applied (advanced).

Rating: I – The instructor will introduce the topic at the level required. It is not necessary for the student to have seen the material before. D – There may be a reminder or review, but the student is expected to have seen and been tested on the material before taking the course. A – It is expected that the student can apply the knowledge without prompting (e. g. no review).

COURSE MATERIALS: Weekly content and guides for the laboratories will be available on the course OWL site. The material for this course will be taught in lectures, tutorials, and labs; therefore, it is imperative that you attend each lecture, tutorial and lab.

UNITS: SI

COURSE TOPICS AND SPECIFIC LEARNING OUTCOMES:

The following table summarizes the course learning outcomes along with CEAB GAIs where the GAIs in bold indicate ones to be measured and reported annually.

COURSE TOPICS AND SPECIFIC LEARNING OUTCOMES	**(CAEB) Graduate Attributes Indicators**
1. Power Flow Studies At the end of this section, students will be able to: **a.** Learn the use of Power World software **b.** Describe, formulate, and solve the power flow problems.	 **ET2, LL1** **PA3**
2. Symmetrical Faults At the end of this section, students will be able to: **a.** Calculate both AC and DC components of symmetrical faults in three-phase AC systems.	 **PA3**
3. Symmetrical Components At the end of this section, students will be able to: **a.** Decouple three-phase AC systems into three sequence networks. **b.** Systematically design and analyze balanced and unbalanced three-phase AC systems using the sequence networks.	 **PA3** **PA3**
4. Unsymmetrical Faults At the end of this section, students will be able to: **a.** analyze line-to-ground, line-to-line, and double line-to-ground faults; and calculate fault currents	 **PA3**
5. Transient Stability At the end of this section, students will be able to: **a.** Explain synchronous machine rotor dynamics, i.e., the swing equation. **b.** Effectively utilize the equal-area criterion for transient stability analysis.	 KB3 **PA3**
6. Introduction to HVDC Transmission and Flexible AC	

Transmission Systems (FACTS) At the end of this section, students will be able to: **a.** Understand the basic operation principles of HVDC transmission **b.** Understand the basic operation principles of FACTS Controllers	KB3
7. Introduction to Standards At the end of this section, students will be able to: **a.** Understand the basic concepts of Standards in power systems operation	**P1**

EVALUATION:

Name	% Worth	Assigned	Due Date	CEAB GAs ASSESSED
Labs (Total = 3)	15%		One week after the Lab	**ET2, LL1**
Quizzes (Total = 3)	20%		In the Tutorial	**PA3**
Mid-Term Examination	25%			KB3, **PA3**
Final Examination	40%			KB3, **PA3, P1**

Note that the dates listed above are **tentative** and may be adjusted if needed. Marks will be assigned on the basis of method of analysis and presentation, correctness of solution, clarity and neatness.

COURSE POLICIES:

All work submitted must be of professional quality in the requested format. Material that is handed in dirty, illegible, disorganized, or in an unapproved format will be returned to the student for resubmission and the late submission penalty will take effect. An additional penalty of 10% may be deducted for poor grammar, incoherence, or lack of flow in the written reports.

HOMEWORK ASSIGNMENTS: The objective of the assignments is to reinforce the covered material and enable the students to use what they learn. There will be four assignments. Each student must independently work on the assignments. Solutions will be provided for these assignments. These assignments will not be graded. However, these assignments will give understanding and practice of problems that will be given in quizzes and examinations.

QUIZZES: Three quizzes will be conducted based on Assignments. These quizzes will be graded. All three quizzes will be counted towards the final course grade.

LABORATORY: PowerWorld simulator software (open source) will be used in the lab to provide the students with hands-on experience and help them become familiar with engineering tools used for power system analysis and design. The Lab manual will be made available on the OWL course website.

Attendance at all laboratory sessions is mandatory. Absence from any session, or a portion of a session, without permission will result in a zero mark assigned to the corresponding laboratory report. The teaching assistants will keep a record of your attendance. Students who arrive 15 min after the scheduled lab time without a legitimate reason, leave the lab early without permission from the teaching assistant, or miss the lab without a legitimate reason will receive a zero mark for the corresponding laboratory assignment. Students who miss a lab with academic consideration are required to contact the course instructor within 2 days for further instructions. Failure to do so will result in a zero mark for that lab.

The laboratory exercises are to be completed in groups; however, each student is required to submit an individual Lab Report.

Lab Report Submission: All lab reports must be submitted electronically via OWL (hard copy will not be accepted). Each submission must be a single PDF file. Any computer code or model that is developed by the student as part of the lab exercise must be submitted along with the PDF file. The files should not be compressed.

LATE SUBMISSION POLICY: All lab reports are due by 23:59 hours on the due date. In case the report cannot be submitted through OWL (due to technical issues), the students can submit them by sending an email to the TA with copy to the instructor. The penalty for an unauthorized late submission of a lab report will be 20% per day of the maximum obtainable mark. Lab reports submitted more than 5 days late will not be accepted and will result in a zero mark.

Advise the instructor if you are having problems completing the assignment on time prior to the due date of the assignment and be prepared to submit an Academic Consideration Request and provide documentation if requested by the instructor at:
https://www.eng.uwo.ca/undergraduate/academic-consideration-for-absences.html

If you are granted an extension, establish a due date with the instructor. The approval of the Chair of your Department is not required if assignments are completed prior to the last day of classes. Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies.

Documentation is mandatory.

MIDTERM TEST: A midterm test of 2 hours will be conducted during the middle of the course. This will be closed book (no notes, books or reference material permitted). Only use of a non-programmable calculator will be permitted. The use of a programmable calculator is not permitted and will be considered as cheating. The date of the exam will be announced on the OWL course website.

Emphasis in the Midterm test will be both on the understanding of core concepts taught in class and the ability to apply those concepts to solve problems. The Midterm test will also contain questions relating to laboratory work.

FINAL EXAMINATION: A three-hour final closed-book (no notes, books or reference material permitted) examination will be conducted during the regular examination period. Only use of a non-programmable calculator will be permitted. The use of a programmable calculator is not permitted and will be considered as cheating.

Emphasis in the final exam will be both on the understanding of core concepts taught in class and the ability to apply those concepts to solve problems. The final examination will also contain questions relating to the laboratory work. The final examination will take place during the regular examination period.

ONLINE ACTIVITIES:

a) *Types of interactive activities:* The Lectures will be conducted on-line through ZOOM. Some Tutorials will be conducted on-line through ZOOM, whereas some will be conducted in-person.

However, all the Labs, Quizzes, Mid Term exam and the Final exam will be conducted in person.

b) *Equipment:*

Students are expected to have a camera including min. resolution – 1080p and a mic.

c) *Expectation:*

Students are expected to have their mic on during Lectures. Use of camera is optional but will be helpful.

Recording Online Activities: All the remote learning sessions for this course will be recorded and posted on OWL for the benefit of all the registered students. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name

displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations.

Please contact the instructor if you have any concerns related to session recordings.

Students are permitted to keep the recordings of remote learning sessions for the exclusive purpose of their own study. Projected material (such as PowerPoint slides) may be subject to copyright and licensing restrictions. Students shall not distribute these recordings and are required to destroy them at the end of the semester.

Students who are having difficulty following the pace of material presented are encouraged to contact the instructor.

Please also contact the course instructor if the above policy adversely affects the accessibility of the course.

ATTENDANCE:

1) Attendance is very highly encouraged for all lectures.
2) Attendance is mandatory for all labs, Tutorials and Quizzes

FACULTY OF ENGINEERING POLICIES:

Students must familiarize themselves with the policies of the Faculty of Engineering
https://www.eng.uwo.ca/electrical//pdf/2025-UG-Policy-and-Procedures.pdf