COURSE OUTLINE
SPRING 2025

	Date	Initials
Prepared by Instructor	03-May	S.Y.
Approved by Head		

1. Calendar Information

ENCM 519.54
High-Voltage Engineering - Group Study in Switzerland

This course covers the fundamental phenomena and principles related to the occurrence of extensive electric field strengths. This knowledge is applied to the dimensioning and use of electrical power system equipment. The course includes practical training in the high-voltage laboratory regarding the generation and measurement of high voltages, component testing and safety aspects.
Prerequisites: Electrical Engineering 487 (Electrical Engineering Energy Systems) or consent of the department.

Course Hours: 3 units; H(3-2)
Academic Credit: 3
Calendar Reference:

2. Learning Outcomes

At the end of this course, you will be able to:

1 understand the principles used to generate high voltages, the methods to calculate and grade electrostatic fields and the mechanisms of partial discharges and breakdown of dielectrics, high-voltage related aspects of electric power system equipment (functionality, safety, normative aspects, testing, diagnosis, maintenance

2 design simple insulation systems using solids, liquids or gases as the insulation medium

3 use different kinds of high voltage sources (Marx, Cockcroft–Walton, RLC resonator, AC)

4 build test circuits and perform measurement and testing on high-voltage equipment (dielectric test, TG delta, partial discharge)

3. Timetable

Section	Day(s) of the Week	Time	Location
LEC 01	TTh	8:00-11:50	HEFR
LAB B01	WF	1:00-5:00	HEFR

4. Course Instructors

Course Coordinator

Section	First Name	Family Name	Phone	Office	Email

L01	Svetlana	Yanushkevich	403-210-5410	ICT343	syanshk@ucalgary.ca

Other Instructors

Section	First Name	Family Name	Phone	Office	Email
L01	Dominiqu	Rolle	41-26-429-6736	C20-09	dominique.rolle@hefr.ch

Teaching Assistants

Section	First Name	Family Name	Phone	Office	Email

5. Assessments

The following examinations will be held in this course:
•One midterm examination (2h, closed book, 10-page manuscript allowed, May 15th 2025)
•Final examination (2h, closed book, 20 page manuscript document allowed, May 27, 2025)
There are laboratories, with pre-lab, lab work and report.
All the lab reports should be handed in before the respective final exam. There is no additional delay possible and the students are advised to hand in their work as early as possible, especially for the labs that took place at the beginning of the class. In case when a student is exceptionally sick, a 4-day extension is permitted.

6. Use of Calculators in Examinations

Non-programmable scientific calculators (without formulae storage and /or text display features) may be used during examinations

7. Final Grade Determination

The final grade in this course will be based on the following components:

Component	Learning Outcome(s) Evaluated	Weight
Laboratory work (Pre-lab + Lab work + Report)	3,4	10%
Midterm examination	1,2	40%
Final examination	1,2	50%

Total: 100%

It is necessary to earn a passing grade on the final exam in order to pass the course as a whole.
Conversion from a score out of 100 to a letter grade will be done using a scale determined after the final examination has been marked. This allows the creation of a scale appropriate to the relative difficulty/easiness of the term work and the final exam. As a rough guideline, the following table shows the scale used in this course in the recent past. Please note that the scale used this year will be similar but probably not identical to scales from other years.

Letter Grade	Total Mark (T)
A+	T ≥ 90.5%
A	86.0% ≤ T < 90.5%
A-	81.5% ≤ T < 86.0%
B+	77.0% ≤ T < 81.5%
B	72.5% ≤ T < 77.0%
B-	68.0% ≤ T < 72.5%
C+	63.5% ≤ T < 68.0%
C	59.0% ≤ T < 63.5%
C-	54.5% ≤ T < 59.0%
D+	50.0% ≤ T < 54.5%
D	45.5% ≤ T < 50.0%
F	T < 45.5%

8. Textbook

No textbook is requred. Handouts will be distributed in the course.

Title	
Author(s)	
Edition, Year	
Publisher	

The following textbook(s) is recommended for this course:

Title	
Author(s)	
Edition, Year	
Publisher	

9. University of Calgary Policies and Supports

SSE ADVISING AND POLICIES

All Schulich School of Engineering students have access to a D2L site titled “Engineering Student Centre”. Students have a responsibility to familiarize themselves with the policies available on this site.

ACADEMIC MISCONDUCT

Academic Misconduct refers to student behavior which compromises proper assessment of a student's academic activities and includes: cheating; fabrication; falsification; plagiarism; unauthorized assistance; failure to comply with an instructor's expectations regarding conduct required of students completing academic assessments in their courses; and failure to comply with exam regulations applied by the Registrar.

For more information on the University of Calgary Student Academic Misconduct Policy and Procedure and the SSE Academic Misconduct Operating Standard, please visit: https://schulich.ucalgary.ca/current-students/undergraduate/student-resources/policies-and-procedures

Additional information is available on the Academic Integrity Website at https://ucalgary.ca/student-services/student-success/learning/academic-integrity

ACADEMIC ACCOMODATION

It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The Student Accommodations policy is available at https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Accommodation-Policy.pdf

Students needing an accommodation based on disability or medical concerns should contact Student Accessibility Services (SAS) in accordance with the Procedure for Accommodations for Students with Disabilities (https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf). SAS will process the request and issue letters of accommodation to instructors. For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/.

Students needing an accommodation in relation to their coursework or to fulfil requirements for a degree based on a Protected Ground other than Disability, should communicate this need by submitting a SSE Request for Academic Accommodation Form (ESC D2L - Forms) to the Associate Head (Undergraduate Studies) within 10 business days prior to the class, test, exam, or assignment at issue.

INSTRUCTOR INTELLECTUAL PROPERTY

Course materials created by instructors (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the instructor. These materials may NOT be reproduced, redistributed or copied without the explicit consent of the instructor. The posting of course materials to third party websites such as note-sharing sites without permission is prohibited. Sharing of extracts of these course materials with other students enrolled in the course at the same time may be allowed under fair dealing.

FREEDOM OF INFORMATION AND PROTECTION OF PRIVACY

Student information will be collected in accordance with typical (or usual) classroom practice. Students' assignments will be accessible only by the authorized course faculty. Private information related to the individual student is treated with the utmost regard by the faculty at the University of Calgary.

COPYRIGHT LEGISLATION

All students are required to read the University of Calgary policy on Acceptable Use of Material Protected by Copyright (https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Acceptable-Use-of-Material-Protected-by-Copyright-Policy.pdf) and requirements of the copyright act (https://laws-lois.justice.gc.ca/eng/acts/C-42/index.html) to ensure they are aware of the consequences of unauthorised sharing of course materials (including instructor notes, electronic versions of textbooks etc.). Students who use material protected by copyright in violation of this policy may be disciplined under the Non-Academic Misconduct Policy https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Non-Academic-Misconduct-Policy.pdf.

MEDIA RECORDING (if applicable)

Please refer to the following statement on media recording of students: https://elearn.ucalgary.ca/wp-content/uploads/2020/05/Media-Recording-in-Learning-Environments-OSP_FINAL.pdf

**Media recording for lesson capture*

The instructor may use media recordings to capture the delivery of a lecture. These recordings are intended to be used for lecture capture only and will not be used for any other purpose. Although the recording device will be fixed on the Instructor, in the event that incidental student participation is recorded, the instructor will ensure that any identifiable content (video or audio) is masked, or will seek consent to include the identifiable student content to making the content available on University approved platforms.

**Media recording for self-assessment of teaching practices*

The instructor may use media recordings as a tool for self-assessment of their teaching practices. Although the recording device will be fixed on the instructor, it is possible that student participation in the course may be inadvertently captured. These recordings will be used for instructor self-assessment only and will not be used for any other purpose.

**Media recording for the assessment of student learning*

The instructor may use media recordings as part of the assessment of students. This may include but is not limited to classroom discussions, presentations, clinical practice, or skills testing that occur during the course. These recordings will be used for student assessment purposes only and will not be shared or used for any other purpose.

SEXUAL VIOLENCE POLICY

The University recognizes that all members of the University Community should be able to learn, work, teach and live in an environment where they are free from harassment, discrimination, and violence. The University of Calgary's sexual violence policy guides us in how we respond to incidents of sexual violence, including supports available to those who have experienced or witnessed sexual violence, or those who are alleged to have committed sexual violence. It provides clear response procedures and timelines, defines complex concepts, and addresses incidents that occur off-campus in certain circumstances. Please see the policy available at https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Sexual-and-Gender-Based-Violence-Policy.pdf

OTHER IMPORTANT INFORMATION

Please visit the Registrar's website at: https://www.ucalgary.ca/registrar/registration/course-outlines
for additional important information on the following:

- Wellness and Mental Health Resources
- Student Success
- Student Ombuds Office
- Student Union (SU) Information
- Graduate Students' Association (GSA) Information
- Emergency Evacuation/Assembly Points
- Safewalk

10. Additional Course Information

Course Format and Scheduling

28 hours of lectures (14 X 2 h) and 24 hours of labs (6 X 4).

Topic and hours:

1. Introduction, use of HV, Maxwell equations, electrical field stresses
2. Conduction and displacement current, dielectric systems, Schwaiger factor
3. AC, DC, current and resonant generator
4. Lightning Phenomenon, Marx generator
5. Overvoltage phenomena and insulation coordination in electric power systems
6. Measurement of high voltages and currents in labs and on the grids
7. Conduction, breakdown, and use of gaseous dielectrics
8. Conduction, breakdown, and use of gaseous dielectrics
9. Conduction, breakdown, and use of liquid dielectrics
10. Conduction, breakdown, and use of solid dielectrics
11. Conduction, breakdown, and use of solid dielectrics
12. HV Cable and line, GIS, breaker
13. Power and measuring transformer, bushing, isolator
14. High voltage testing of electrical apparatus

Laboratory Experience and hours:

1. Safety instruction, practice in high voltage laboratory, breakdown in air, Cockcroft–Walton generator
2. AC generator, Schwaiger factor and Paschen Law
3. Marx generator, lighting and switching impulses
4. Resonant generator, current impulses
5. Partial discharges, dielectric testing and tg delta
6. Breakdown in solids and liquids