



Fall 2023

ECE660: Operation and Control of Future Integrated Energy Systems

COURSE COORDINATOR: PROF. MEHRDAD KAZERANI, ECE DEPARTMENT (mkazerani@uwaterloo.ca)

SUMMARY:

The course will provide a comprehensive overview of the operation and control of the integrated energy systems of the future. The course will be offered in 11 modules, each module discussing a specific aspect of the subject, to provide a broad spectrum of coverage and understanding. Many emerging issues related to the paradigm of *smart electricity grids*, such as energy storage, demand response and microgrids, will be discussed. The course will provide a multi-disciplinary perspective on the energy system of the future and will be open to graduate students from all engineering streams.

OBJECTIVES:

- ❖ To provide an understanding of the philosophy of smart grids
- ❖ To develop an understanding of the issues, and the technical and economic aspects of energy systems
- ❖ To develop a multi-disciplinary perspective on future energy systems

Study Material:

- Presentation slides of lectures will be provided.
- Other associated reading material (research papers, etc.) will be made available.

Examination:

- Written midterm and final exams (25% each): 50%
 - Project Work: 50%
- Students opting for AUDIT will have to complete the project work satisfactorily.

STRUCTURE OF THE COURSE AND DELIVERY:

- The course is delivered in modular form, each module delivered by a faculty member with expertise on the topic. Lectures will be held IN-PERSON.
- [REDACTED]

MODULE	TITLE	INSTRUCTOR	LECTURE SCHEDULE
1	FUTURE POWER GRIDS: GENERATION, TRANSMISSION, DISTRIBUTION, INTELLIGENT LOADS	MAGDY SALAMA	MONDAY, SEPTEMBER 11 TH
2	DISTRIBUTED ENERGY RESOURCES	CLAUDIO CANIZARES	MONDAY, SEPTEMBER 18 TH
3	MICROGRIDS: PART-1	CLAUDIO CANIZARES	MONDAY, SEPTEMBER 25 TH
4	MICROGRIDS: PART-2	CLAUDIO CANIZARES	MONDAY, OCTOBER 2 ND
5	DC GRIDS	RAMADAN EL-SHATSHAT	MONDAY, OCTOBER 16 TH
6	APPLICATION OF MACHINE LEARNING IN POWER SYSTEM ASSET ASSESSMENT	AYMAN EL-HAG	MONDAY, OCTOBER 23 RD
	MIDTERM EXAM	MEHRDAD KAZERANI	MONDAY, OCTOBER 30 TH
7	TRANSPORTATION ELECTRIFICATION	MEHRDAD KAZERANI	MONDAY, NOVEMBER 6 TH
8	INSULATION INTEGRITY OF THE FUTURE GRID	SHESHA JAYARAM	MONDAY, NOVEMBER 13 TH
9	EVOLVING ELECTRICITY MARKETS & SYSTEM OPERATIONS	KANKAR BHATTACHARYA	MONDAY, NOVEMBER 20 TH
10	TRANSACTIVE ENERGY SYSTEMS	MOHAMMAD NASSAR	MONDAY, NOVEMBER 27 TH
11	ENVIRONMENTAL, SOCIAL AND POLITICAL CONTEXT OF FUTURE ENERGY SYSTEMS	JESSIE MA	MONDAY, DECEMBER 4 TH

CONTINENCY PLAN & ALTERNATIVE ARRANGEMENTS FOR CANCELLATIONS AND COVID IMPLICATIONS

- In the case of a short-term (e.g., one-week) cancellation of in-person lectures, whether for the course or University-wide, lectures will be rescheduled during the following weeks.
- In the case of a long-term cancellation of in-person lectures, whether for the course or University-wide, lectures will be held online, and recorded lectures will be made available to students.
- In the case of cancellation of in-person exam (midterm or final), an online version of the exam will be given to students via email, with the same starting time and duration as the cancelled in-person exam. Detailed instructions, outlining how to complete the examination, will be sent to students, before the online exam date.
- For students who cannot attend classes due to self-isolation, and need clarifications or support beyond posted course material, an online meeting will be held.

ACADEMIC INTEGRITY, GRIEVANCE, DISCIPLINE, APPEALS AND NOTE FOR STUDENTS WITH DISABILITIES:

See www.uwaterloo.ca/accountability/documents/courseoutlinestmts.pdf

The information extracted from this website is given below.

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check www.uwaterloo.ca/academicintegrity/ for more information.]

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, www.adm.uwaterloo.ca/infosec/Policies/policy70.htm. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity [check www.uwaterloo.ca/academicintegrity/] to avoid committing an academic offence and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, www.adm.uwaterloo.ca/infosec/Policies/policy71.htm. For typical penalties check Guidelines for the Assessment of Penalties, www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm.

Appeals: A decision made, or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals) www.adm.uwaterloo.ca/infosec/Policies/policy72.htm.

Note for Students with Disabilities: The Office for persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term. (<https://uwaterloo.ca/disability-services/>)