

Faculty of Engineering Department of Mechanical Engineering COURSE OUTLINE

MECH 580 A04 – Digital Twins in Energy Systems

Term – Fall 2022 (202209)

Instructor	Office Hours
Jamil Fayyad	Days: TBD
Phone: -	Time: TBD
E-mail: jfayyad@uvic.ca	Location: ECS 349

Instructor in Charge	
Dr. Curran Crawford	
Phone:	
E-mail: curranc@uvic.ca	

LECTURE DATE(S)

Section: A04/CRN: 12287 Days: TF	Time: 12:30-1:50pm	Location: Clearihue (CLE) A216
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HEALTH & SAFETY

- COMPLETE A PERSONAL HEALTH CHECK every day. Do not come to class/lab if you are in any way sick. Simply let the instructor/TA know, and accommodations will be made. No doctor's note required.
- With the ever-evolving COVID situation please follow current health and safety guidelines.

TEACHING ASSISTANT

TA Name	E-mail	Office
Jayden Hong	jaydenh@uvic.ca	ECS 349

TEXTBOOK

There is no required textbook. See Brightspace for details on readings available online through library EZProxy links or uploaded files.

COURSE OBJECTIVES:

This course will introduce the concept of a Digital Twin (DT) as motivational for the study of various meta/surrogate models drawn from optimization, Uncertainty Quantification (UQ), and Machine Learning (ML) approaches. The course does not aspire to be a `data science/analytics' course, as these are widely available online. Rather, the focus is on understanding how the concepts associated with DTs are finding applications in energy systems for design and optimization, predictive maintenance and monitoring, control, and energy forecasting. Interested students may also explore non-energy related applications of the(DT) concept and associated methods (e.g. manufacturing, biomedical).

LEARNING OUTCOMES: At the end of this course, students will be able to:

- 1. Describe the concept of a DT
- 2. Identify and describe the functionality of sub-elements and methods applicable to DTs

- 3. Describe challenges associated with data acquisition and curation
- 4. Communicate how DT approaches are being developed and employed for energy systems applications
- 5. Apply regression and classification modelling techniques commonly employed in DT architectures
- 6. Utilize Python for model development and visualizations

ASSESSMENT

Weight & Date(s) of Assessments:	UGrad Weight	Grad Weight
Case Studies	35% (group)	25% (group)
Assignments	65% (individual)	35% (individual)
Project	-	40% (individual)

All elements of the course will be marked using the UVic 0-9 (F-A+) marking scheme available in the <u>UVic calendar</u>. The wording used to describe each grade level will be used to evaluate each course deliverable; percentage grades for each course component will be assigned at the mid-point of each grade range (e.g. 74.5% for B grade). The final course grade will use the grade weighting below to compute a weighted final % grade (and corresponding final 0-9/letter grade for the course). Students should familiarize themselves with the comprehension and performance levels associated with each grade level and contribute to the coursework accordingly, noting that a B/B+ represents full completion to a standard level and A- to A+ going beyond to deeper insights.

NOTES

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

COURSE LECTURE NOTES

Unless otherwise noted, all course materials supplied to students in this course are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.

COURSE SCHEDULE

(May be subject to change)

See Brightspace for details and re-check regularly to keep up-to-date throughout the term.

General Information

Note to Students: Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Assistant to the Chair to set up an appointment.

Centre for Accessible Learning (CAL) https://www.uvic.ca/services/cal/

Accommodation of Religious Observance (AC1210) Read it here

Discrimination and Harassment Policy (GV0205) Read it here

Sexualized Violence Prevention and Response at UVic:

UVic takes sexualized violence seriously, and has raised the bar for what is considered acceptable behaviour. We encourage students to learn more about how the university defines sexualized violence and its overall approach by visiting https://www.uvic.ca/sexualizedviolence/. If you or someone you know has been impacted by sexualized violence and needs information, advice, and/or support please contact the sexualized violence resource office in Equity and Human Rights (EQHR). Whether or not you have been directly impacted, if you want to take part in the important prevention work taking place on campus, you can also reach out: Where: Sexualized violence resource office in EQHR; Sedgewick C119
Phone: 250.721.8021
Email: svpcoordinator@uvic.ca
Web: https://www.uvic.ca/sexualizedviolence/

Office of the Ombudsperson:

The Office of the Ombudsperson is an independent and impartial resource to assist with the fair resolution of student issues. A confidential consultation can help you understand your rights and responsibilities. The Ombudsperson can also clarify information, help navigate procedures, assist with problem-solving, facilitate communication, provide feedback on an appeal, investigate and make recommendations. **Phone:** 250-721-8357 **Email:** ombuddy@uvic.ca **Web:** https://uvicombudsperson.ca/

Electronic devices in labs and lectures: No unauthorized audio or video recording of lectures is permitted.

Electronic devices in midterms and exams: Calculators are only permitted for examinations and tests if explicitly authorized and the type of calculator permitted may be restricted. No other electronic devices (e.g. cell phones, pagers, PDA, etc.) may be used during examinations or tests unless explicitly authorized.

Faculty of Engineering, University of Victoria Standards for Professional Behavior

It is the responsibility of all members of the Faculty of Engineering, students, staff, and faculty, to adhere to and promote standards of professional behavior that support an effective learning environment that prepares graduates for careers as professionals...

You are advised to read the Faculty of Engineering document <u>Standards for Professional Behavior</u> which contains important information regarding conduct in courses, labs, and in the general use of facilities.

Graduate Students' Society

The Graduate Students' Society (GSS) serves all students registered in an Graduate degree program. For information on GSS activities, events and services navigate to <u>https://gss.uvic.ca/</u>

Grading System

The University of Victoria follows a percentage grading system in which the instructor will submit grades in percentages. The University will use the following Senate approved standardized grading scale to assign letter grades. Both the percentage mark and the letter grade will be recorded on the academic record and transcripts. Read the policy <u>here</u>

Course Experience Survey (CES)

We value your feedback on this course. Towards the end of term you will have the opportunity to complete a confidential course experience survey (CES) regarding your learning experience. The survey is vital to providing

feedback to me regarding the course and my teaching, as well as to help the department improve the overall program for students in the future. When it is time for you to complete the survey, you will receive an email inviting you to do so. If you do not receive an email invitation, you can go directly to the <u>http://ces.uvic.ca</u>

You will need to use your UVic NetLink ID to access the survey, which can be done on your laptop, tablet or mobile device. I will remind you closer to the time, but please be thinking about this important activity, especially the following three questions, during the course.

- What strengths did your instructor demonstrate that helped you learn in this course?
- Please provide specific suggestions as to how the instructor could have helped you learn more effectively.
- Please provide specific suggestions as to how this course could be improved.

Attendance

Students are expected to attend all classes in which they are enrolled. An academic unit may require a student to withdraw from a course if the student is registered in another course that occurs at the same time... An Instructor may refuse a student admission to a lecture, laboratory, online course discussion or learning activity, tutorial or other learning activity set out in the course outline because of lateness, misconduct, inattention or failure to meet the responsibilities of the course set out in the course outline. Students who neglect their academic work may be assigned a final grade of N or debarred from final examinations. Students who do not attend classes must not assume that they have been dropped from the course by an academic unit or an instructor. Courses that are not formally dropped will be given a failing grade, students may be required to withdraw and will be required to pay the tuition fee for the course. Read the policy <u>here.</u>

Academic Integrity

Academic integrity is intellectual honesty and responsibility for academic work that you submit individual or group work. It involves commitment to the values of honesty, trust, and responsibility. It is expected that students will respect these ethical values in all activities related to learning, teaching, research, and service. Therefore, plagiarism and other acts against academic integrity are serious academic offences.

The responsibility of the institution Instructors and academic units have the responsibility to ensure that standards of academic honesty are met. By doing so, the institution recognizes students for their hard work and assures them that other students do not have an unfair advantage through cheating on essays, exams, and projects.

The responsibility of the student Plagiarism sometimes occurs due to a misunderstanding regarding the rules of academic integrity, but it is the responsibility of the student to know them. If you are unsure about the standards for citations or for referencing your sources, ask your instructor. Depending on the severity of the case, penalties include a warning, a failing grade, a record on the student's transcript, or a suspension.

It is your responsibility to understand the University's policy on <u>Academic Integrity</u>

Equality

This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require

accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to contact the Centre for Accessible Learning (formerly the Resource Centre for Students with a Disability) located in the Campus Services Building.

The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.