

# COURSE OUTLINE

---

## ECE 573 Advanced Engineering Design By Optimization

### Term – SPRING 2021 (202101)

#### Instructor

Dr. Wu-Sheng Lu  
Phone: 8692  
E-mail: [wslu@ece.uvic.ca](mailto:wslu@ece.uvic.ca)

#### Office Hours

No face-to-face office hours.  
Questions to be addressed by e-mails and recorded lecture videos.  
Course website: <https://www.ece.uvic.ca/~wslu/603/index.html>

#### Course Objectives

To learn fundamental theory, main stream contemporary methods and algorithms of constrained optimization. Applications of these algorithms to real-world problems in engineering and science will be an integral part of the course.

#### Learning Outcomes

Thorough understanding of the basic concepts and theory of constrained optimization; working knowledge of the methods and algorithms to be covered by the course.

#### Syllabus

<b><u>Unconstrained Optimization – A Review</u></b>	3
Unconstrained optimization problems. Gradient descent, Newton, and quasi-Newton algorithms.	
<b><u>Fundamentals of Constrained Optimization</u></b>	7
Lagrange multipliers. First-order necessary conditions. Second-order conditions.	
<b><u>Convexity and Duality</u></b>	7
Convex sets and functions. Properties and classes of convex functions. Lagrange dual functions and problems.	
<b><u>LP, QP, SDP, SOCP Problems and Software</u></b>	7
Linear and quadratic programming. Semidefinite programming (SDP). Second-order cone programming (SOCP). CVX.	
<b><u>Algorithms for General Convex Problems</u></b>	7
Subgradient and conjugate functions. $L_1$ - $L_2$ minimization. Alternating direction method of multipliers.	
<b><u>Algorithms for General Nonconvex Problems</u></b>	7
Sequential convex programming method. Sequential QP programming. Convex-concave procedure (CCP). ADMM heuristics.	

A-Sections: A01/CRN 20953, A02/CRN 23954

Days: Two pre-recorded video lectures, each lasts 75 – 80 minutes, will be posted each week on the course website.

Time: One pre-recorded video lecture will be posted each Tuesday and Friday.

Link: <https://www.ece.uvic.ca/~wslu/603/index.html>

#### Required Text

Title: Online lecture notes.

Author: Wu-Sheng Lu

Year: January 2021.

#### Online Course Delivery:

As this course will be conducted online during this term, students will need to complete assignments online. The students will require access to a computer which has the following software installed: MATLAB, CVX.

**References:** See the course notes.

**Assessment:**

Assignments:	30 %	Due Dates: to be posted.
Project:	15 %	To be due on the same day as the final exam.
Final Exam:	55 %	

**Important: All deadlines and schedules for this course will reference Pacific Standard Time until March 14, 2021 and then Pacific Daylight Time.**

**Note:** Failure to pass the final exam will result in a failing grade for the course.

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 Graduate Calendar.

<https://www.uvic.ca/calendar/archives/202101/grad/index.php#/policy/B13jeiMdE?bc=true&bcCurrent=07%20-%20Grading&bclItem=policies>

**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 Chair's Secretary to set up an appointment.

**Course Withdrawal Deadlines:**

- January 19, 2021: Withdrawal with 100% reduction of tuition fees (under review)
- February 9, 2021: Withdrawal with 50% reduction of tuition fees (under review)
- February 28, 2021: Last day for withdrawal (no fees returned) (under review)

**Accommodation of Religious Observance:**

<https://www.uvic.ca/calendar/archives/202101/grad/index.php#/policy/SkmigiMOV?bc=true&bcCurrent=17%20-%20Accommodation%20of%20Religious%20Observance&bclItem=policies>

**Policy on Inclusivity and Diversity:**

Engineering: <https://www.uvic.ca/engineering/about/equity/index.php>

Academic Calendar:

<https://www.uvic.ca/calendar/archives/202101/grad/index.php#/policy/HkQ0pzdAN?bc=true&bcCurrent=%20General%20University%20Policies&bcGroup=General%20University%20Policies&bclItem=policies>

**Standards of Professional Behaviour:**

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

<http://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf>

**Academic Integrity:**

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the entry in the current Graduate Calendar for the UVic policy on academic integrity.

[https://www.uvic.ca/calendar/archives/202101/grad/index.php#/policy/BJujesM\\_E?bc=true&bcCurrent=02%20-%20Policy%20on%20Academic%20Integrity&bclItem=policies](https://www.uvic.ca/calendar/archives/202101/grad/index.php#/policy/BJujesM_E?bc=true&bcCurrent=02%20-%20Policy%20on%20Academic%20Integrity&bclItem=policies)

**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 located in the Campus Services Building: <https://www.uvic.ca/services/cal/>. 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.

**Course Lecture Notes:**

Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and 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.

**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 [www.uvic.ca/svp](http://www.uvic.ca/svp). 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](mailto:svpcoordinator@uvic.ca)

**Web:** [www.uvic.ca/svp](http://www.uvic.ca/svp)

**Office of the Ombudsperson:**

The [Office of the Ombudsperson](https://uvicombudsperson.ca/) 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](mailto:ombuddy@uvic.ca), Website: <https://uvicombudsperson.ca/>