



**University
of Manitoba**

Electrical and Computer Engineering

ECE 7670 OPTIMIZATION METHODS FOR COMPUTER-AIDED DESIGN COURSE OUTLINE - JANUARY 2021

Course Objectives

To introduce mathematical optimization techniques that can be used for the solution of engineering design and inverse problems. The formulation of the various types of multivariable optimization problems amenable to computer solution. To study and implement some relevant algorithms to solve such problems.

Contact hours

3 lecture hours/week, 13 weeks (three credit hour course)

Time: TBD - Based on student schedules who enrol

Prerequisites

A firm grasp of mathematical concepts normally covered in an undergraduate electrical engineering curriculum, including: multivariable calculus, linear analysis, algorithm development, and programming.

Course content

Most of the following topics will be covered:

1. Mathematical concepts and formulation of multivariable optimization.
2. Classical methods of unconstrained optimization.
3. Zero, first and second order direct search techniques and algorithms for unconstrained optimization.
4. Linear programming.
5. Constraints - equality and inequality, optimality criteria.
6. Numerical techniques for constrained optimization.
7. Neural Networks as an optimization problem.

If time permits:

8. Game theory as an optimization problem.
9. Strategies for global optimization.
10. Minimization of functionals.

Textbook

E.K.P. Chong, S.H. Zak, "An Introduction to Optimization", 4th Edition, John Wiley and Sons, Inc., 2013.

Recommended Reference Books

1. S. S. Rao, "Engineering Optimization: Theory and Practice," 4th Edition, John Wiley & Sons, 2009.
2. A. Beck, "Introduction to Nonlinear Optimization Theory, Algorithms, and Applications with MATLAB," SIAM, 2014.
3. R. K. Arora, "Optimization: Algorithms and Applications," Chapman and Hall/CRC, 2015.

4. L.E. Scales, "Introduction to Non-Linear Optimization," Springer-Verlag, 1985.
5. D.G. Luenberger, "Optimization by Vector Space Methods," John Wiley & Sons, 1969.

Evaluation

The final course grade will be determined from a student's performance in several assignments, a project, and a final examination. The project will be chosen by the student, with the approval of the instructor, in an area of his or her interest and will demonstrate the application of an optimization algorithm discussed in the course. The weighting of each of these components will be as follows:

<u>Component</u>	<u>Weight</u>
5 Assignments	50%
Final Exam	50%

Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations and Requirements of the University of Manitoba, Section 7.1, students are reminded that "plagiarism or any other form of cheating in examinations or term tests (e.g. crib notes) is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty."

Instructor

Prof. Joe LoVetri, Ph.D., P.Eng

Room EITC E3-546

Telephone: (204) 474-6295

Email: Joe.LoVetri@UManitoba.Ca