

Western University
Faculty of Engineering
Department of Electrical & Computer Engineering

ECE9504b / ECE9054b – Optimization Techniques

COURSE OUTLINE 2020-2021

DESCRIPTION:

The aim of the course is to introduce mathematical optimization techniques for the solution of engineering analysis and design problems. Students will learn to formulate multivariable engineering problems as optimization problems amenable to computer solution. The details of specific techniques required to solve the mathematical problems will be covered. Students will be required to write MATLAB programs to implement and use the relevant algorithms to solve optimization problems.

PREREQUISITES:

An undergraduate degree in Engineering or a related field. This course requires a strong background in linear algebra and familiarity with MATLAB.

TOPICS:

- 1) Formulation of engineering problems as optimization problems.
- 2) Mathematical concepts.
- 3) Single-variable optimization.
- 4) Multi-variable unconstrained optimization.
- 5) Advanced techniques for unconstrained optimization.
- 6) Equality and inequality constraints and optimality criteria.
- 7) Techniques for constrained optimization.
- 8) Advanced topics in optimization (if time permits).

SPECIFIC LEARNING OUTCOMES:

1. To introduce the concept of mathematical optimization and to show how many engineering problems can be formulated as optimization problems.
2. To analyze and program (search) techniques for single-variable optimization.
3. To analyze and understand the properties of “classical” first- and second-order methods for multivariable unconstrained optimization.
4. To understand the structure of numerical unconstrained optimization techniques and to provide experience in using these techniques.
5. To introduce the fundamental concepts of constrained optimization and to understand the key features of constrained optimization techniques.

ASSESSMENTS:

The final course grade will be determined from students' performance in a mid-term test (closed book) and a final exam (open book). The weighting of each of these components will be as follows:

Component	Value
Mid-Term Test	40%
Final Examination	55%
Participation (synchronous: attendance in class activities)	5%

CONTACT INFORMATION:

Course instructor: R.V. Patel

Email address: rvpatel@uwo.ca

Contact policy:

- Contact instructor via email (above) or through messages in OWL
- A general FAQ section on the 'forums' section of OWL will be used for students to pose course-related questions so that all have the same information.

RECOMMENDED REFERENCE BOOKS:

1. E.K.P. Chong and S.H. Zak, An Introduction to Optimization, John Wiley & Sons, Inc., New York, 1996.
2. G.V. Reklaitis, A. Ravindran, K.M. Gagsdell, Engineering Optimization: Methods and Applications, John Wiley and Sons, 1983, (ENG:TA-342.R44 1983).
3. P.R. Adby and M.A.H. Dempster, Introduction to Optimization Methods, Chapman and Hall, 1974.
4. R. Fletcher, Practical Methods of Optimization, John Wiley & Sons, 1987.
5. D.G. Luenberger, Linear and Nonlinear Programming, Addison-Wesley, 1984.

COURSE CONTENT:

Class notes and relevant online lecture material will be posted on OWL. The class notes and online material are copyrighted to the instructor and legally protected. Do not post these class notes and online material on any other website or online forums. The recording of the live/synchronous sessions of the course without the permission from the instructor is prohibited. The illegal posting and sharing of the copyrighted course content could be subjected to legal actions.

CHEATING, PLAGIARISM/ACADEMIC OFFENCES:

Academic integrity is an essential component of learning activities. Students must have a clear understanding of the course activities in which they are expected to work alone (and what working alone implies) and the activities in which they can collaborate or seek help; see information above under "Assessments" and ask instructor for clarification if needed. Any unauthorized forms of help-seeking or collaboration will be considered an academic offense. University policy states that cheating is an academic offence. If you are caught cheating, there will be no second warning. Students must write their essays and assignments in their own words. Whenever students take an

idea or a passage of text from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence. Academic offences are taken seriously and attended by academic penalties which may include expulsion from the program. Students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence (see Western's scholastic discipline regulations for graduate students).

SYNCHRONOUS LEARNING ACTIVITIES:

Students are expected to participate in synchronous learning activities as outlined in the course syllabus and/or described by the instructor. If you have issues that will impede your ability to participate in synchronous activities, please discuss with the course instructor at the beginning of the course.

CONDUCT:

Students are expected to follow proper etiquette during synchronous and asynchronous activities to maintain an appropriate and respectful academic environment. Any student who, in the opinion of the instructor, is not appropriately participating in the synchronous and asynchronous learning activities and/or is not following the rules and responsibilities associated with the online learning activities, will be reported to the Associate Dean (Graduate) (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Associate Dean (Graduate), the student could be debarred from completing the assessment activities in the course as appropriate.

HEALTH/WELLNESS:

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several health and wellness related services (remotely accessible) to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. Information regarding health- and wellness-related services available to students may be found at <http://www.health.uwo.ca/>.

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html
<https://www.uwo.ca/health/psych/index.html>

SICKNESS:

Students should immediately consult with the Instructor (for a particular course) or Associate Chair (Graduate) (for a range of courses) if they have problems that could affect their performance. The student should seek advice from the Instructor or Associate Chair (Graduate) regarding how best to deal with the problem. Failure to notify the Instructor or the Associate Chair (Graduate) immediately (or as soon as possible thereafter) will have a negative effect on any appeal. Obtaining appropriate documentation (e.g., a note from the doctor) is valuable when asking for accommodation due to illness.

ACCESSIBILITY:

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at 661-2111 x 82147 or http://academicsupport.uwo.ca/accessible_education/index.html, for any specific question regarding an accommodation.