ECE 4860 T14 – Optimization Techniques

Winter 2021

IMPORTANT NOTICE – Mandatory Requirement to Report
This course will be conducted using remote instruction. Students who are accessing the course from outside of Canada or the USA must notify the instructor and indicate in which country they are located. Access to software may be restricted from some countries and failure to comply with these restrictions may result in criminal prosecution.

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.

Course Content
Most of the following topics will be covered:

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

If time permits:

- Game theory as an optimization problem.
- Strategies for global optimization.
- Minimization of functionals.

Textbook

Recommended Reference Books

Learning Outcomes
1. Comprehend the different classifications of unconstrained and constrained optimization problem formulations.
2. Understand and apply the different types of unconstrained optimization techniques that are available using high-level software tools.
3. Implement in computer code some of the different techniques to get a better understanding of how they work.
4. Formulate engineering design problems as an optimization problem and apply the techniques that have been learned.

Price Faculty of Engineering
Department of Electrical and Computer Engineering
CEAB Graduate Attributes Assessed

PA.4 – Evaluates a solution to a complex engineering problem.

CS.2 – Designs and produces appropriate engineering documents (i.e. research reports, engineering reports, design documents, graphics)

Evaluation

The final course grade is determined by the student’s performance in laboratories, on the project and presentation, and on an examination. Students must complete all the laboratories in order to be eligible to receive a passing grade.

* Method of Feedback: F - Formative (written comments and/or oral discussion), S - summative (numerical grade)

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 on Academic Integrity, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

Requirements/Regulations

- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a passing final grade.
- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with the University’s General Academic Regulations, as well as Section 3 of the Faculty of Engineering Academic Regulations dealing with incomplete term work, deferred examinations, attendance and withdrawal.
- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.
- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.

Grading Scale

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<tr>
<th>Letter</th>
<th>Mark</th>
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<tr>
<td>A+</td>
<td>95–100</td>
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<tr>
<td>A</td>
<td>85–94</td>
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<tr>
<td>B+</td>
<td>80–84</td>
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<td>B</td>
<td>70–79</td>
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<tr>
<td>C+</td>
<td>65–69</td>
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<tr>
<td>C</td>
<td>55–64</td>
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<td>D</td>
<td>45–54</td>
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<td>F</td>
<td>&lt; 45</td>
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Note: These boundaries represent a guide for the instructor and class alike. Provided that no individual student is disadvantaged, the instructor may vary any of these boundaries to ensure consistency of grading from year-to-year.
Copyright Notice

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Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading, and to support the ongoing accreditation of each Engineering program. This material shall be handled in accordance with the University’s Intellectual Property Policy and the protection of privacy provisions of The Freedom of Information and Protection of Privacy Act (Manitoba). Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.