MATH 4335
Introduction to Optimization
2024-25 Spring

Midterm Exam date: 12:00 pm—1:20 pm, Mar. 24, 2025

Lecture

Time	Monday and Wednesday: 12:00 PM-1:20 PM
Venue	4503 (lift 25-26)
Instructor	**Dr. Guibo YE**
E-mail	magbye@ust.hk
Office	Room 3419, Department of Mathematics

Tutorial

session	T1A
Time	Thursday 04:30-05:20 PM
Venue	Room 2406
Teaching Assistant	**WU, Tong**
E-mail	twubi@connect.ust.hk

Course Description

Course outline: This course introduces fundamental theory and techniques of optimization. Topics include linear programming, unconstrained optimization, and constrained optimization. Numerical implementations of optimization methods are also discussed.

Credits: 3

Prerequisites: A passing grade in Math 2011/MATH2021/Math2023, and Math 2111/MATH2121/MATH2131

Exclusion: NIL

Intended Learning Outcomes (ILOs)

Upon completion of this course, students are expected to be able to:

(1) Be equipped with of fundamental knowledge of optimization
(2) Develop an understanding of basic algorithms of optimization and their implementations.
(3) Set up optimization models for application problems.
(4) Solve optimization problems independently.
(5) Implement some algorithms by software such as MATLAB or Python.
(6) Communicate using correct mathematical terminology

Assessment and Grading

Homework: There will be 5 or 6 problem sets. The homework is assigned in Canvas. Students should submit the homework online before the deadline.

Examinations: There will be a one hour and twenty minutes midterm exam on Mar. 24 12:00pm–1:20pm, and a 3-hour final exam arranged by ARO. The exams are all closed-book exams. No calculators or any electronic devices are allowed.

Make-up midterm policy:

- Under any circumstance, students who are unable to attend the midterm exam will **not** be offered a make-up midterm that takes place after the regular exam session.
- For students who have valid reasons for missing the midterm, the instructor may approve an early midterm, or assign the midterm marks according to the final exam performance.
- On other hand, for students who miss the midterm without a valid reason, the midterm score will be regarded as 0. This includes self-claimed sickness without any medical statement.

The course will follow the make-up exam policy set by ARO for the final exam. Approval from the instructor, the dean, and ARO will be needed for applying for a make-up final exam.

Grading Scheme:

This course will be assessed using **criterion-referencing**, and grades will **not** be assigned using a curve (nor a surface). Your course total will be calculated by taking the following scheme:

	Scheme	Address ILOs
Homework	15%	1, 2, 3, 4, 5, 6
Midterm	25%	1, 2, 3, 4, 6
Final	60%	1, 2, 3, 4, 6
Course Total	100%	

Letter Grades: Students should aim at getting a course total of 85% or above for A-/A/A+ and about a course total of 35% or above to get a pass grade.

Grade Descriptors:

Grades	Short Description A	Elaboration on subject grading description
A	Excellent Performance	The student has mastered almost all concepts and techniques of optimization taught in the course, has excellent understanding of the deepest content of the subject, and acquired workable knowledge for further studies of optimization and their applications.
B	Good Performance	The student has mastered most concepts and computational techniques of optimzation taught in the course, yet the understanding of some challenging concepts may not be deep enough for further studies on related advanced subjects.
C	Satisfactory Performance	The student meets the minimum expectation of the instructor, has acquired some basic computational techniques of the subject, yet some concepts were not clearly understood.
D	Marginal Pass	The student is only able to recall some fragments of topics and is able to complete some of the easiest computations.
F	Fail	The student does not have sufficient understanding of even some fragments of topics, and is not even able to complete some of the easiest computations.

TEXTBOOKS AND OTHER RESOURCES

(1) An introduction to optimization, Edwin K. P. Chong, Stanislaw H. Zak, 4th edition, Wiley
(2) Linear and Nonlinear Optimization, Igor Griva, Stephen G. Nash, Ariela Sofer, 2nd edition, SIAM
(3) Convex optimization, Stephen Boyd, Lieven Vandenberghe, Cambridge University Press. The electronic version is available in https://web.stanford.edu/ boyd/cvxbook/bv_cvxbook.pdf

COURSE SCHEDULE (ABOUT 33 HOURS)

Keyword Syllabus:

(1) Introduction to optimization, review of related knowledge of multivariable calculus and linear algebra, convexity
(2) Unconstrained optimization: optimality conditions, gradient methods, Conjugate-Gradient method, Newton's method, Quasi-Newton methods, Least-squares fitting
(3) Linear programming: Introduction, standard form, dual problem, duality theory
(4) Nonlinear optimization: Optimality conditions for constrained problems, convex optimization, Interior-point methods, ADMM algorithm

Course AI Policy

Students are allowed to consult any person (including the instructor, TA, classmates, friends outside HKUST) in any homework for ideas and hints, but are required to write up the solutions by themselves.

You are required to **list the persons and references** you have consulted in every homework for all written homeworks.

The use of ChatGPT or other generative AI is allowed, and they are regarded as "persons" you have consulted, and therefore must be listed in your homework.

However, please be warned that at the current stage of development of AI, the response to problems in advanced courses is not quite reliable. Students should be critical of the response generated by AI and do not blindly copy the generated responses to your homework.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct.