

**City University of Hong Kong  
Course Syllabus**

**offered by Department of Management Sciences  
with effect from Semester A 2024 / 2025**

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**Part I Course Overview**

<b>Course Title:</b>	Convex Optimization
<b>Course Code:</b>	MS8946
<b>Course Duration:</b>	One Semester
<b>Credit Units:</b>	3
<b>Level:</b>	R8
<b>Medium of Instruction:</b>	English
<b>Medium of Assessment:</b>	English
<b>Prerequisites:</b> <i>(Course Code and Title)</i>	MS8941 Linear and Discrete Optimization
<b>Precursors:</b> <i>(Course Code and Title)</i>	Nil
<b>Equivalent Courses:</b> <i>(Course Code and Title)</i>	Nil
<b>Exclusive Courses:</b> <i>(Course Code and Title)</i>	Nil

## Part II Course Details

### 1. Abstract

This course aims to introduce the students the fundamentals of convex optimization. The main topics include Lagrangian duality, Newton’s Method, Ellipsoid Method, Interior Point Method, and the basics of conic optimization. The students are expected to be able to understand the solvability and time complexity for different models, know how to establish efficient models for practical problems, use Matlab or other softwares to solve them, and most important of all, read research papers in OR/OM field.

### 2. Course Intended Learning Outcomes (CILOs)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	A2	A3
1.	Under the basic concepts of convex optimization theory		✓	✓	
2.	Know how to model problems as convex programming			✓	✓
3.	Able to solve convex optimization problems			✓	
4.	Understand different methods and the cons/pros of them		✓	✓	
5.	Able to read research papers in OR/OM or related area		✓	✓	
6.	Apply the models/theories in practice/research topics			✓	✓
		100%			

A1: Attitude

*Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.*

A2: Ability

*Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.*

A3: Accomplishments

*Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.*

### 3. Learning and Teaching Activities (LTAs)

LTA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4	5	6	
Interactive lecture	Students will have group discussion on the topics that provided during lecture.	✓	✓	✓	✓			3
Course Project	Students will have group projects.					✓	✓	1

**4. Assessment Tasks/Activities (ATs)**

Assessment Tasks/Activities	CILO No.						Weighting	Remarks
	1	2	3	4	5	6		
Continuous Assessment: <u>60</u> %								
Assignments	✓	✓	✓	✓			30%	
Group Projects				✓	✓	✓	30%	
Examination: <u>40</u> % (duration: 2 hours, if applicable)								
Examination	✓	✓	✓	✓			40%	
							100%	

## 5. Assessment Rubrics

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignments	To solve the problems correctly with good understanding of concepts and methods	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Group Projects	Clear presentation showing good understanding of concepts and methods	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	To solve the problems correctly with good understanding of concepts and methods	High	Significant	Moderate	Basic	Not even reaching marginal levels

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Assignments	To solve the problems correctly with good understanding of concepts and methods	High	Significant	Moderate	Not even reaching marginal levels
2. Group Projects	Clear presentation showing good understanding of concepts and methods	High	Significant	Moderate	Not even reaching marginal levels
3. Examination	To solve the problems correctly with good understanding of concepts and methods	High	Significant	Moderate	Not even reaching marginal levels

## Part III Other Information

### 1. Keyword Syllabus

Convex, Lagrangian Duality, Strong Duality, Gradient, Hessian, Time Complexity, Sublinear/Superlinear Convergence, Newton's Method, Ellipsoid Method, Interior Point Method, Cone, Second Order Cone (SOC), Semidefinite Cone (SDP).

### 2. Reading List

#### 2.1 Compulsory Readings

Nil.

#### 2.2 Additional Readings

1.	Cottle: Lectures Notes on Optimization, 2004.
2.	Boyd, Vandenberghe: Convex Optimization, Cambridge University Press, 2004.
3.	Luenberger, Ye: Linear and Nonlinear Programming (3rd Edition), 2008.
4.	Ben-Tal, Nemirovski: Optimization I-II: Convex Analysis, Nonlinear Programming Theory, Nonlinear Programming Algorithms, 2004.
5.	Bertsekas, Nedic, Ozdaglar: Convex Analysis and Optimization. Athena Scientific.
6.	Nemirovski: Lectures on Modern Convex Optimization, 2005.
7.	Softwares: CVX <a href="http://cvxr.com/cvx/">http://cvxr.com/cvx/</a> , Sedumi <a href="http://sedumi.ie.lehigh.edu/">http://sedumi.ie.lehigh.edu/</a>