City University of Hong Kong
Course Syllabus

offered by College/School/Department of Management Sciences
with effect from Semester A 2017 /18

Part I Course Overview

Course Title:	Convex Optimization
Course Code:	MS8946
Course Duration:	One Semester
Credit Units:	3
Level:	R8
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	MS8941 Linear and Discrete Optimization
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

(A 150-word description about the course)

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)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

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%			

** If weighting is assigned to CILOs, they should add up to 100%.*

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4	5	6	
Interactive lecture	During lectures, topics will be provided for students for group discussion.	✓	✓	✓	✓			3
Course Project	Group Projects will be provided.					✓	✓	1

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4	5	6		
Continuous Assessment: __60__%								
Assignments	✓	✓	✓	✓			30%	
Group Projects				✓	✓	✓	30%	
Examination: __40__% (duration: 2 hours, if applicable)								
Examination	✓	✓	✓	✓			40%	
** The weightings should add up to 100%.*							100%	

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

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

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

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

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

Nil

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

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 http://cvxr.com/cvx/, Sedumi http://sedumi.ie.lehigh.edu/