City University of Hong Kong
Course Syllabus

offered by Department of Management Sciences
with effect from Semester A 2018/2019

Part I Course Overview

Course Title:	**Optimization Methods**
Course Code:	**MS 3601**
Course Duration:	**1 semester**
Credit Units:	**3**
Level:	**B3**
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)*	**MA 2001 Multi-variable Calculus and Linear Algebra** **Or subject to instructor's approval**
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 students to the theory, algorithms, and applications of optimization. The optimization methodologies include linear programming, nonlinear optimization, integer programming, robust optimization, and dynamic programming. Topics include the simplex method, duality, integer programming formulation, convex analysis, optimality conditions for nonlinear optimization, and optimal control methods. Applications to finance will be emphasized.

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.	Explain clearly basic concepts of linear, integer, non-linear, and dynamic programming.		√		
2.	Solve problems of linear, integer, non-linear and dynamic programming with appropriate methods in optimization.		√	√	
3.	Formulate real-world problems by appropriate optimization models.		√	√	√
		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	
Lecture	Learning through teaching primarily based on lectures.	√	√	√	√	3
Assignments	Learning through take-home assignments helps students understand techniques of basic methods in optimization as well as their applications in solving real-world problems.	√	√	√	√	2

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		
Continuous Assessment: _40_%						
Assignments	√	√	√	√	20%	
Mid-term test	√	√	√	√	10%	
End-of-term test	√	√	√	√	10%	
Examination: _60__% (duration: 2 hours)						
** 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 demonstrate techniques of applying optimization methods in a diversity of problems.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Mid-term test	How far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student's versatility in basic methods of mathematical programming.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. End-of-term test	How far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student's versatility in basic methods of mathematical programming.	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Exam	How far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student's versatility in basic methods of mathematical programming.	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

Examples of Optimization Problems. Simplex Method for Linear Programming Problems. Duality Theory of Linear Optimization. Integer Programming formulation. Convexity, optimal conditions, quadratic programming with applications in finance. Robust portfolio optimization. Dynamic programming and optimal control with applications in trading strategies.

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.)

1.	Dimitri Bertsimas and John Tsitsiklis. Introduction to linear programming. Athena Scientific.1997
2.	Dimitri Bertsekas, Angelia Nedić and Asuman Ozdaglar. Convex analysis and Optimization. Athena Scientific. 2003.

2.2 Additional Readings

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

1.	Dimitri Bertsekas. Dynamic programming and optimal control. Athena Scientific. 2007
2.	Frank J. Fabozzi. Robust portfolio optimization and management. Wiley. 2007