City University of Hong Kong
Course Syllabus

offered by Department of Systems Engineering
with effect from Semester A 2024 / 25

Part I Course Overview

Course Title:	Optimization and Applications
Course Code:	SYE8201
Course Duration:	One semester
Credit Units:	3
Level:	R8
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	SEEM8201 Optimization and Applications (offered until 2021/22) ADSE8201 Optimization and Applications (offered until 2023/24)
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course aims to further develop students' abilities to apply optimization theory and methods for the solutions of mathematical optimization models. The course will cover linear optimization, unconstrained optimization, constrained optimization, integer optimization, and stochastic optimization. Students will learn how to formulate problems as mathematical optimization models and to solve the models with optimization theory and methods.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes		
			A1	*A2*	*A3*
1.	Formulate linear optimization models and apply simplex methods and interior-point methods to solve linear optimization models	10%			
2.	Apply gradient descent methods, stochastic gradient descent methods and trust-region methods to solve unconstrained optimization problems	25%			
3.	Develop necessary and sufficient optimality conditions for constrained optimization and apply sequential quadratic optimization methods, interior-point methods and alternating direction methods of multipliers to solve constrained optimization problems	35%			
4.	Formulate integer optimization models and apply branch-and-bound methods and cutting-plane methods to solve integer optimization models	10%			
5.	Formulate stochastic optimization models and apply stochastic dynamic programming methods and progressive-hedging methods to solve stochastic optimization models	20%			
		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	
Lectures	Learning through teaching is primarily based on lectures. Mini-lectures and tutorials will be used to facilitate understanding and applications of various concepts and methods.	✓	✓	✓	✓	✓	2 hours/week
Group Activities	The homework exercises provide students with the opportunities to familiarize themselves with the methods learnt during the lectures.	✓	✓	✓	✓	✓	1 hour/week
Consultation Hours	Discussions of Course Materials	✓	✓	✓	✓	✓	1 hour/week/ 25 students

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.					Weighting	Remarks
	1	2	3	4	5		
Continuous Assessment: 50 %							
Participation and Exercises: Students need to participate actively in in-class activities such as class exercises and discussions designed to facilitate their understanding of knowledge and mastering in skills of modelling and problem solving taught in class.	✓	✓	✓	✓	✓	20%	
Case Studies & Mini Projects: Students are required to effectively apply knowledge and skills learned from the course in modelling, analyzing and solving some simple practical problems.	✓	✓	✓	✓	✓	30%	
Examination: 50 % (duration: 2 hrs , if applicable)							
Students will be assessed via the examination their understanding of concepts and mastering in skills of modelling and problems solving learned in class, textbooks and reading materials and their ability to apply subject-related knowledge.	✓	✓	✓	✓	✓	50%	
						100%	

For a student to pass the course, at least 30% of the maximum mark for the examination should be obtained.

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. Participation & Exercises	Submitted solutions to individual assignments.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Case Studies & Mini Projects	Submitted group work and presentations.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	Submitted solutions to the final examination.	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. Participation & Exercises	Submitted solutions to individual assignments.	Excellent	Good	Marginal	Failure
2. Case Studies & Mini Projects	Submitted group work and presentations.	Excellent	Good	Marginal	Failure
3. Examination	Submitted solutions to the final examination.	Excellent	Good	Marginal	Failure

Part III Other Information

1. Keyword Syllabus

1. Linear Optimization
2. Unconstrained Optimization
3. Constrained Optimization
4. Integer Optimization
5. Stochastic Optimization

2. Reading List

2.1 Compulsory Readings

1.	Convex Optimization, Stephen Boyd and Lieven Vandenberghe

2.2 Additional Readings

1.	D.P. Bertsekas, Nonlinear Programming Athena Scientific, Belmont, MA, any edition.