City University of Hong Kong
Course Syllabus

offered by Department of Management Sciences
with effect from Semester A 2024/25

Part I Course Overview

Course Title:	**Optimization Theory and Method**
Course Code:	MS8953
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)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course aims to provide students a comprehensive understanding of linear programming, convex optimization, dynamic programming and stochastic control. Students are trained to make optimal decisions under deterministic and stochastic environments. Applications in inventory control and pricing strategy are demonstrated. This course is designed to introduce fundamental models and technical tools of solving real world problems to PhD students, and to train their original thinking skills and prepare them for advanced research in the fields of operations research and operation management.

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.	Enhance proficiency of formulating problems with linear, convex and dynamic programming models	20%		✓	
2.	Understand and analyse the fundamental models of inventory and pricing theory	20%		✓	
3.	Apply the models/theories in practice/research topics	20%		✓	
4.	Solve the basic optimization models and analyse the optimal policy of multi-period problem	30%		✓	
5.	Generate new research concepts and deduce solutions.	10%			✓
		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 real-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		
Interactive lecture	Students will actively participate in the group discussion, during lectures, and learn the explanations and theories of optimization models	✓	✓	✓	✓			
Outside Classroom Activities	Students will be required to evaluate, criticize the research paper and create new research ideas in related topics. Student will also be required to conduct a presentation. Important recent research papers will be recommended for reading after class.					✓		

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.						Weighting	Remarks
	1	2	3	4				
Continuous Assessment: __70__%								
Assignments	✓	✓	✓	✓			40%	
Midterm Exam	✓	✓	✓	✓			30%	
Examination: __30__% (duration: 3 hours)								
Examination	✓	✓	✓	✓			30%	
							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	Ability of understanding the model and applying methodology learnt to the related problems.	High	Significant	Moderate	Basic	Not even reaching marginal level
2. Midterm Exam	Evidence of knowledge on the concepts, techniques and ideas learnt in the first half of the semester.	High	Significant	Moderate	Basic	Not even reaching marginal level
3. Final Exam	Evidence of knowledge on subject matter and	High	Significant	Moderate	Basic	Not even reaching marginal level

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	Ability of understanding the model and applying methodology learnt to the related problems.	High	Significant	Moderate	Not even reaching marginal level
2. Midterm Exam	Evidence of knowledge on the concepts, techniques and ideas learnt in the first half of the semester.	High	Significant	Moderate	Not even reaching marginal level
3. Final Exam	Evidence of knowledge on subject matter and Evidence of knowledge on subject matter and using the techniques to solve the related problems. Evidence of creative ideas on related research topics.	High	Significant	Moderate	Not even reaching marginal level

Part III Other Information

1. Keyword Syllabus

- Linear Optimization: Formulation, geometry, optimality, simplex method, duality, sensitivity analysis, interior point method, complementary-slackness condition
- Convex Optimization: convexity, epigraph, conjugate function, Lagrangian dual, Newton's method, KKT condition, semi-definite programming
- Dynamic programming, Optimal Control, Newsvendor Problem, Newsvendor Problem with Price-effect, Finite Horizon Inventory Control, Integration of Inventory and Pricing

2. Reading List

2.1 Compulsory Readings

Nil

2.2 Additional Readings

1.	Dimitris Bertsimas and John N.Tsitsikilis: Introduction to Linear Optimization
2.	Boyd, Vandenberghe: Convex Optimization, Cambridge University Press, 2004
3.	D. Bertsekas. Dynamic Programming and Optimal Control. Vol 1. Third Edition. 2005
4.	D. Simchi-Levi. X.Chen and J. Bramel. The Logic of Logistics; Theory, Algorithms, and Applications for Logistics and Supply Chain Management. Second Edition. 2005