City University of Hong Kong
Course Syllabus

offered by College/School/Department of _Mathematics_____
with effect from Semester __A____ 20_20_ / _21_

Part I Course Overview

Course Title:	**Combinatorial and Network Optimization**
Course Code:	**MA4525**
Course Duration:	**One semester**
Credit Units:	**3 credit units**
Level:	**B4**
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)*	**MA2504 Discrete Mathematics, or** **MA2509 Discrete Mathematics**
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 introduces basic concepts of graph theory, methods of combinatorial and network optimization, coding theory for network optimization to minimize the error. It also helps students apply combinatorial techniques to solve a range of application problems in optimization, graph and network modeling.

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 concepts and methods for some fundamental combinatorial optimization problems, including traveling salesman problem and minimum spanning tree problem.	30%	✓		
2.	formulate and implement methods and computational algorithms to solve problems on combinatorial and network optimization over discrete domains.	25%		✓	✓
3.	manipulate techniques in coding theory for error minimization across network channels.	20%		✓	✓
4.	formulate and analyze real-world problems in framework of combinatorial optimization and graph/network models.	25%	✓	✓	✓
	** If weighting is assigned to CILOs, they should add up to 100%.*	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			
Lectures	Learning through **teaching** is primarily based on lectures.	✓	✓	✓	✓			39 hours in total
Take-home assignments	Learning through **take-home assignments** helps students understand principles and techniques of combinatorial and network optimization methods, as	✓	✓	✓	✓			after-class

	well as the applications of which in practical problems.							
Project(s)	Learning through **project(s)** helps students apply mathematical and computational ideas of combinatorial/network optimization methods to a concrete application on scheduling or transportation. It also helps students to communicate and collaborate effectively in the team.		✓	✓	✓			after-class

4. Assessment Tasks/Activities (ATs)

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

30% Coursework

70% Examination (Duration: 3 hours, at the end of the semester)

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

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4				
Continuous Assessment: _30___%								
Test	✓	✓					15-30%	Questions are designed for the first part of the course to see how well students have learned techniques of combinatorial optimization in solving application problems.
Hand-in assignments	✓	✓	✓	✓			0--15%	These are skills based assessment which enables students to apply methods of combinatorial optimization and coding theory as well as concepts of graphs/network models in diverse applications.
Project		✓	✓	✓			0--15%	Students are assessed on their ability in applying computational methods of combinatorial optimization and knowledge of graphs/networks to model a real-life problem, as well as on the presentation of results with analysis.

Examination: __70__% (duration: 3 hrs , if applicable)		Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student's versatility in combinatorial optimization and network modeling.
** 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. Test	Ability in problem solving	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Hand-in assignments	Understanding of concepts and applications	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Project	Creativity and Team work ability	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examination	Comprehensive ability in independent problem solving	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.)

Trees and spanning trees. Traveling salesman problem. Shortest path problem. Minimum cost flow problem. Maximum flow problem. Matchings and coverings in graphs. Graph coloring. Coding theory.

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.	Douglas B. West, *Introduction to Graph Theory* (2nd Ed). Prentice Hall, 2000.
2.	John A. Dossey , Albert D. Otto , Lawrence E. Spence, Charles V. Eynden, *Discrete Mathematics* (5th Ed). Addison Wesley, 2005.
3.	
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2.2 Additional Readings

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

1.	
2.	
3.	
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