City University of Hong Kong
Course Syllabus

offered by Department of Management Sciences
with effect from Semester A 2016/2017

Part I   Course Overview

Course Title:	**Simulation**
Course Code:	**MS3106**
Course Duration:	**One 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)*	**CB2200 Business Statistics; or** **MS3102 Statistics for Management Decisions; or** **MA2506 Probability and Statistics and MS2602 Statistical Inference**
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 with methods and procedures involved in the planning, design, implementation, execution and interpretation of computer simulation experiments; develop students' abilities in constructing simulation experiments of moderate size; enable students to use simulation experiments in order to analyse business problems.

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	be able to apply Monte Carlo simulation by using tools such as Excel in real life business applications, which will require them to be able to generate random varieties for various continuous and discrete distributions	40%		✓	
2	be able to use the analytical skills of a discrete-event simulation, which includes inputting data collection and analysis, model building, model verification and validation, and output analysis	40%		✓	
3	be able to identify and solve real business problems using simulation	20%			✓

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

(1: least important, 3: most important)

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	
1	Interactive Lecture: Concepts on Monte Carlo simulation and discrete event simulations, system modelling techniques. 1. Students listen to lectures and respond to questions after a brief group discussion;	✓	✓	✓	

	2. They read business cases and related videos that illustrate system modelling and process improvements and demonstrate process improvement techniques.				
2	Computer laboratory: Students work in groups to apply simulation techniques to problems drawn from operations, revenue management, investment and accounting, etc. Students should critically evaluate the solutions and draw their own insights.	✓	✓	✓	
3	Case study: A group of students work in teams to conduct a case study for a real-world entity by simulation and present their findings in a collaboratively document and an in-class presentation	✓	✓		
4	Individual assignments: Students are required to apply simulation skills in several business problems.	✓			

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		
Continuous Assessment: 40%					
Case Study (Course Project)	✓	✓	✓	20%	
In-Class Exercises	✓	✓	✓	10%	
Individual Assignments	✓			10%	
Examination: 60 % (duration: 2 hrs, if applicable)					
Written Examination	✓	✓	✓	60%	
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. Attendance/Class Participation		No less than 90% attendance. Actively participates in and facilitates class discussions. Asks thoughtful questions and answers actively	No less than 80% attendance. Participates in class discussions. Asks and answers some questions	No less than 60% attendance	No less than 30% attendance	Complete Absence
2. Individual Assignment & In Class Exercise		Strong evidence of knowing how to apply simulation to solving given problems; A+ solutions have to be beyond expectations in terms of solution ideas, originality and results presentation, etc.	Evidence of knowing how to apply simulation software in solving given problems; shows a complete solution procedure, with basically correct results.	Some evidence of knowing how to apply simulation software in solving given problems; shows basic steps and results.	Shows basic steps to try to solve the problems; while the results are not exact or correct; the students at this level are expected to progress without repeating the assignment	Little evidence of familiarity with the subject matter
3. Case Study		Strong evidence of original thinking; good organization, capacity to analyse and synthesize; excellent demonstration of taught knowledge or even beyond; strong evidence of extensive knowledge base.	Correct identification and abstraction of a real business problem, together with a complete solution through simulation. A good demonstration of the taught knowledge. Some evidence of critical capacity and analytic ability. Reasonable understanding of issues	Acceptable identification and abstraction of a real business problem, together with a basic solution based on simulation. Demonstrates a basic grasp of the taught knowledge.	Shows a clear attempt to solve the problems along the correct path and sufficient familiarity with the subject matter; but the results may not be satisfactory enough. The students at this level are expected to be able to progress independently afterwards without repeating the case report.	Little evidence of familiarity with the subject matter; weakness in critical and analytic skills; limited or irrelevant use of taught knowledge.

4. Examination		Strong evidence of original thinking; good organization, capacity to analyse and synthesize; excellent demonstration of taught knowledge; shows the ability to assimilate new knowledge easily; evidence of extensive knowledge base.	Evidence of being able to apply taught knowledge to solve given problems; some evidence of critical capacity and analytic ability; reasonable understanding of issues;	Able to solve problems with the correct procedure, while the results may not be exact or complete; ability to develop solutions to simple problems in the material.	Shows a clear attempt along the correct path, while unable to solve the problems in time; expected to be able to teach self to progress without repeating the course.	Little evidence of familiarity with the subject matter; weakness in critical and analytic skills; limited or irrelevant use of literature.

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.)

Introduction
What is simulation.   Intuitive examples.   Simulation Applications.   Modern simulation technology.

Random Variates Generation
Random number generator.   Generating continuous and discrete random variates.

Monte Carlo simulation.
Applications in inventory control, project management and financial analysis, etc.

Input Data Collection and Analysis
Collect data necessary for modelling the system and analysing the output.   Selecting input probability distributions.   Parameter Estimation.   Test of goodness-of-fit.

Model building
Building Models using various techniques. ProModel.

Model Verification and Validation
Verification and validation.   Face validity.   Validation of model assumptions.   Validate input-output transformations.

Output Data Analysis
Output analysis for a single system and comparison of alternative system configurations.

Simulation Workshop
Cases involving production, logistics and service systems.

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.	W. L. Winston, S. C. Albright, M. Broadie (2002). Practical Management Science, 2nd edition, Thomson Learning.
2.	D. Kelton W., P. S. Randall, and N. Zupick. (2009) Simulation with Arena. 5th edition, Mc Graw Hill, New York.

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

1.	Averill M. Law, W. David Kelton (2000) Simulation modeling and analysis, 3rd edition, Boston: McGraw-Hill.