City University of Hong Kong
Course Syllabus

offered by College/School/Department of _Mathematics_____
with effect from Semester __A____ 20_22_ / _23_

Part I Course Overview

Course Title:	**Introduction to Stochastic Processes**
Course Code:	**MA4546**
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)*	**MA2506 Probability and Statistics, or** **MA2510 Probability and Statistics**
Precursors: *(Course Code and Title)*	**Nil**
Equivalent Courses: *(Course Code and Title)*	**SDSC4019 Stochastic Processes and Applications**
Exclusive Courses: *(Course Code and Title)*	**Nil**

Part II Course Details

1. Abstract

(A 150-word description about the course)

This course is an introduction to the probability models and stochastic processes (without measure theory). It aims to develop and analyse stochastic models with applications. It also provides elementary numerical methods for solving real stochastic 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.	explain concepts of stochastic processes, Markovian property, transition probability and master equation	30%	✓		
2.	describe the theory of discrete time and continuous time Markov process, explain the definitions and properties of Poisson process and Brownian motion.	30%	✓		
3.	perform basic numerical methods to compute limiting distributions and mean first passage time	20%		✓	
4.	apply basic knowledge of Markov processes to analyze stochastic problems in practice.	10%			✓
5.	the combination of CILOs 1-4.	10%		✓	
		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	5		
Lectures	Learning through **teaching** is primarily based on lectures.	✓	✓	✓	✓	✓		39 hours in total
Take-home assignmens	Learning through **take-home assignments** helps students understand basic concepts and theories of curves and surfaces.	✓	✓	✓	✓			after-class

4. Assessment Tasks/Activities (ATs)

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

40% Coursework

60% Examination (Duration: 2 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	5			
Continuous Assessment: _40___%								
Test	✓	✓		✓			15%	Questions are designed for the first part of the course to see how well students have learned the concepts and theories of stochastic processes.
Quiz	✓	✓		✓	✓		15%	These are skills based assessment to help students understand concepts and basic methods in stochastic models.
Formative take-home assignments	✓	✓	✓	✓			10%	The assignments provide students chances to demonstrate their understanding of properties of stochastic process and their achievements on stochastic modelling learned in this course.
Examination (duration: 2 hrs)	✓	✓	✓	✓	✓		60%	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 concepts and theories of stochastic processes and probability models.
** 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	Correct application of methods and correct calculations	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Quiz	Skills of solving problems	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Formative take-home assignments	Submission on time and independent work	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examination	Overall performance of understanding key concepts, applying right methods and performing correct computation	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.)

Random walk, Poisson process, Brownian motion, discrete-time and continuous-time Markov process, stationary distribution, occupancy measure, Chapman-Kolmogorov equation, master equation, first passage time, Markov Chain Monte Carlo.

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.	Introduction to Modeling and Analysis of Stochastic Systems, Second Edition, by V.G. Kulkarni, Springer, 2011
2.	
3.	

2.2 Additional Readings

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

1.	Understanding Markov Chains: Examples and Applications, by Nicolas Privault, Springer Undergraduate Mathematics Series, 2013.
2.	Introduction to Probability Models, Tenth Edition, by Sheldon M. Ross, Academic Press, 2009
3.	An Introduction to Stochastic Modeling, Third Edition, by Howard Taylor and Samuel Karlin, Academic Press, 1998