

Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): **SCI 3510 MATHEMATICAL AND STATISTICAL MODELLING**
(3,3,1)

Course Aims: This course aims to facilitate students' working knowledge of the basic principles of mathematical and statistical modelling. It is designed to equip students with an understanding of how mathematics can be applied to solve problems arising in various disciplines. The case study approach is adopted in which the modelling process is described by means of a number of examples with different characteristics. Where possible, problems are modelled in more than one way to illustrate the flexibility and diversity involved in mathematical modelling, and students will gain first hand experience in a mini-project.

Prerequisite: MATH1120, and one of MATH2110 or MATH2230

Prepared by: C.S. Tong

Learning Outcomes (LOs):

Upon successful completion of this course, students should be:

No.	Learning Outcomes (LOs)
	Knowledge
1	Able to understand the basic techniques in mathematical and statistical modelling
2	Able to understand the major issues involved when applying mathematics to model real life problems
3	Able to compare and contrast some examples of discrete, continuous and stochastic models through concrete case studies
4	Able to adopt appropriate computing techniques for modelling
	Skills
5	Able to simplify a sophisticated real world problem by making relevant assumptions
6	Able to apply mathematical knowledge and techniques to formulate and model real-life problems
7	Able to evaluate or criticize the appropriateness of various approaches
8	Able to write well-structured report and present methodology and results coherently
	Attitudes
9	Able to work effectively in a team and facilitate self-awareness of leadership skills and sense of responsibility
10	Able to build up an open-minded attitude and appreciate that real life problems may be tackled along different approaches

Assessment:

No.	Assessment Methods	Weighting	Remarks
1	Assignments	40%	Assignments are designed to measure students understanding of the examples of modelling discussed in class.
2	Mini-project & presentation		The mini-project is designed to facilitate students working in a team environment to implement creative modelling solutions to real life problems. Students also have to present their ideas in class, to the instructor in individual sessions, as well as to make a final project presentation. Peer assessment will also be used to facilitate students' reflection of their leadership skills and sense of responsibility.
3	Final Examination	60%	Final Examination is designed to see how far students have achieved their intended learning outcomes especially in the Knowledge domain. There will also be a section in which students are evaluated on their ability to apply modelling techniques to novel scenarios that they have not seen before.

Learning Outcomes and Weighting:

Content	LO No.	Teaching (in hours)
I. Problem Solving	1-3, 5-7, 10	8
II. Case Studies I	1-3, 5-6	12-15
III. Case Studies II	1-3, 5-6	12-15
IV. Mini-Project	4, 7-8, 9-10	12

- References:** R. Haberman, Mathematical Models, SIAM, 1998.
 Michael Mesterton-Gibbons, A Concrete Approach to Mathematical Modelling, Addison-Wesley, 1989.
 G. Polya, How to Solve It, 2nd Edition, Princeton University Press, 1988.

Software: Matlab and other mathematical/statistical software as required

Course Content in Outline:

	<u>Topic</u>	<u>Hours</u>
I.	Problem Solving	8
	A. Overview of steps in modelling	
	B. Brainstorming techniques	
	C. Illustrative examples	
II.	Case Studies I	12
	A. Topics selected by instructor to illustrate continuous models (eg population dynamics, and traffic flow models)	
III.	Case Studies II	12
	A. Topics selected by instructor to illustrate discrete models (eg markov chains)	
IV.	Mini-Project — Problem Formulation, Articulation of Goals and Methodology, Project Report and Presentation	20