MA4540: MODELLING AND CASE STUDIES

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Modelling and Case Studies

Subject Code
MA - Mathematics
Course Number
4540

Academic Unit
Mathematics (MA)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
MA2508 Multi-variable Calculus; and MA2503 Linear Algebra

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract
This course is project-oriented and can be managed by one to a few faculties including visiting professors. The students are equipped with the necessary mathematical modeling techniques in a range of physical problems during the first few weeks.

A test and some hand-in assignments are given for the first part of the course to see how well students have learned the basics of discrete, continuous and stochastic models, as well as the computing techniques necessary for model formulation. Then, the students are divided into small groups and work on projects with diversified research topics. The group project gives the students an opportunity to develop the ability to integrate and apply knowledge and analytical skill to practical situations. As they work in small groups, it also trains their team work ability and communication skill. The students may need to produce short intermediate reports to show the progress of their research. Finally, each group gives a presentation and submits a group report. This provides training to their presentation skill and enhances their report writing ability.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	evaluate and contrast some examples of discrete, continuous and stochastic models.	15	x	x	
2	construct and identify relevant simplifying assumptions to a more sophisticated real-world problem.	10		x	
3	integrate mathematical knowledge and numerical techniques in formulating a problem to solvable models.	25		x	x
4	assess critically appropriateness of various models in approaching the problem.	10	x		
5	write well-structured report and present methodology and results coherently.	20			x
6	the combination of CILOs 1-5	20	x	x	x

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.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Learning through lectures helps students acquire basic mathematical modeling techniques.	1, 2, 3, 4	8 hours in total
2	Tutorials	Learning through tutorialsencourages class participation (inthe form of questions and discussions) and exchange ofacademic ideas among students.	1, 2, 3, 4, 5	5 hours in total

3	Laboratorysessions	Learning through laboratorysessions is primarily based oninteractive problem solving andhand-on computing exercisesallowing instant feedback.	3, 4	13 hours in total
4	Project	Learning through project helps students apply knowledge and computing techniques to model and analyze a more sophisticated real life problem on applied mathematics. It also helps students to communicate and collaborate effectively in the team.	1, 2, 3, 4, 5, 6	13 hours in total

Assessment Tasks / Activities (ATs)

	ATs	**CILO No.**	**Weighting (%)**	**Remarks (e.g. Parameter for GenAI use)**
1	Test	1, 3	20	Questions are designed for the first part of the course to see how well students have learned the basics of discrete, continuous and stochastic models, as well as the computing techniques necessary for model formulation.
2	Hand-in assignments	1, 2, 3, 4, 5	30	These are skills based assessment which enables students to apply knowledge of various types of mathematical models in analyzing physical problems.
3	Project	2, 3, 4, 5	50	Students are assessed on their ability in applying numerical and computational methods to model real-life phenomena or problems, as well as on the presentation of numerical and analytical results.

4	Formative take-home assignments	1, 2, 3, 4, 5	0	The assignments provide students chances to demonstrate their achievements on mathematical modeling learned in this course.

Continuous Assessment (%)
100

Examination (%)
0

Additional Information for ATs
100% coursework

Assessment Rubrics (AR)

Assessment Task
1. Test

Criterion
Ability in problem solving

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
2. Hand-in assignments

Criterion
Understanding of concepts and applications

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
3. Project

Criterion
Creativity and Team work ability

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
4. Formative take-home assignments

Criterion
Study attitude

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

Discrete and continuous models. Stochastic models. Case studies.

Reading List

Compulsory Readings

	Title
1	A first course in mathematical modelling, by Frank R. Giordano, William P. Fox and Steven B. Horton, Cengage Learning, 2013.
2	Mathematical models in the applied sciences, by A. C. Fowler, Cambridge Texts in Applied Mathematics. Cambridge University Press, Cambridge, 1997.

Additional Readings

	Title
1	Nil