The Hong Kong University of Science and Technology
UG Course Syllabus

Course Title: Capstone Project in Applied Mathematics
Course Code: MATH4992
No. of Credits: 3
Pre-requisite(s): LANG3010 or LANG3011, and MATH3312

Name: Prof LEUNG, Shing Yu
Email: masyleung@ust.hk
Office Hours: By appointment

Course Description
This is a project-based course that provides students an opportunity to integrate and apply their mathematical knowledge. Students will be assigned to a section according to their program or track. Upon completion of projects, students are required to submit written reports following standard professional formats.

Intended Learning Outcomes (ILOs)
By the end of this course, students should be able to:

1. Explain advanced mathematical theories, concepts and principles using precise mathematical language.
2. Apply independent judgment to investigative mathematical work.
3. Apply a rigorous logical and analytic approach to execute tasks and solve mathematical problems.
4. Work independently and collaborate effectively in a team.
5. Communicate mathematical concepts and methods effectively to a range of audiences, both orally and in writing.
6. Evaluate individual performance to identify and work towards targets for personal, academic and career development.
7. Apply the fundamental principles and conventions of ethical scientific practice and academic integrity.
8. Analyze the influence of mathematical sciences and their impact of human activity.
9. Draw on a global perspective and sound scientific evidence to evaluate the role of mathematical sciences in the international science community.

Assessment and Grading
This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:
Project Proposal (10%) + Weekly Progress (20%) + Meeting Reflections (10%) + Report (30%) + Oral Exam (30%)

Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	**Explanation**
Project Proposal	ILOs 1,2,3,5,7,8,9	Students define a suitable mathematical question, explain the relevant mathematical background, connect a MATH 3312 topic with an Applied Mathematics elective, and justify their proposed methods. The proposal also assesses initial written communication, independent judgement, methodological planning, ethical considerations, broader impact, and the project's relationship to the international mathematical or scientific literature.
Weekly Progress	ILOs 2,3,4,6,7	Weekly progress assesses sustained investigative work, including mathematical development, implementation, testing, verification, problem-solving, and revision in response to evidence or feedback. It also provides evidence of independent responsibility, effective collaboration, progress towards development targets, proper record-keeping, attribution, and responsible scientific practice.
Meeting Reflections	ILOs 2,4,6,7	Students reflect on feedback, decisions, difficulties, individual contributions, and collaborative work. They identify strengths and areas for improvement, set specific personal, academic, or career-development targets, and evaluate subsequent progress. The reflections also assess whether students recognise and respond appropriately to ethical or academic-integrity issues arising during the project.
Report	ILOs 1,2,3,5,7,8,9	The report provides the principal written evidence of mathematical understanding, independent judgement, logical analysis, and rigorous numerical investigation. Students must explain the mathematical theory and

		methods, verify their computations, interpret results, acknowledge all sources and external tools, and discuss limitations. They must also evaluate the project's influence on human activity and place the work within the broader international mathematical or scientific context.
Oral Exam	ILOs 1,2,3,4,5,7,8,9	The oral exam assesses students' ability to explain mathematical concepts and numerical methods clearly to an audience, present evidence, defend methodological decisions, and respond logically to questions. For team projects, it also demonstrates coordination and shared understanding. Students must communicate the ethical considerations, limitations, broader human significance, and international scientific context of their work.

Reports Rubric

	Exemplary	Competent	Developing
Structure	The structure is **well organized** and easy to follow **throughout.**	The structure is **mostly organized** and **somewhat** easy to follow.	The structure is **somewhat organized** but **hard to follow** in places.
Clarity	**Most** ideas clearly expressed and **understandable**	Ideas clearly expressed **most of the time**	Ideas **lack details** at times **impeding understanding**.
Accuracy	**All** numerical results are accurately computed and are correctly described.	**Most** numerical results are accurately computed and are correctly described.	**Most** numerical results are accurately computed but **lack of any correct description**.
References	Ideas supported with **full references**	**Most** ideas supported with references	Ideas supported with **insufficient** references

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent	Demonstrates exceptional understanding of advanced mathematical theories; produces high-quality project work and presentations; effectively communicates complex concepts.
B	Good	Shows a strong grasp of mathematical concepts; produces solid project work with minor issues; communicates ideas clearly and effectively.
C	Satisfactory	Meets basic requirements of the course; demonstrates adequate understanding but may have inconsistencies in project execution or communication.
D	Marginal Pass	Shows limited understanding of key concepts; struggles with project work and communication; meets only the minimum criteria for passing.

F	Fail	Fails to demonstrate understanding of course material; unable to complete project requirements or communicate effectively; does not meet course expectations.

Course AI Policy
Students in this course are allowed to use AI tools (such as large language models, code generators, or computational assistants) for any assessment, including homework, quizzes, and exams.

Communication and Feedback
Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include strengths and areas for improvement. Students who have further questions about the feedback including marks should consult the instructor within five working days after the feedback is received.

Resubmission Policy
Resubmission of reports or assignments is generally not permitted once they have been graded. Exceptions may be made only under special circumstances (e.g., documented medical or personal reasons) and with prior approval from the course instructor. In such cases, the resubmitted work must be accompanied by an explanation of revisions, and the maximum achievable grade may be capped. Students are strongly encouraged to seek feedback during the drafting stage and make use of consultation opportunities before submission deadlines.

Required Texts and Materials
- Nil

Academic Integrity
Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

Course Schedule

Weeks 1-2	**Sept 1 (Tim):** General introduction. What and why capstone project? Mathematical Modeling. **Sept 3 (Tim):** Examples **Sept 7 Tutorial:** No Class **Sept 8 (Tim):** How to write a MATH report and give a presentation? **Sept 10 (Albert):** LaTex
Weeks 3-5	Meeting 1
Weeks 6-8	Meeting 2
Weeks 8-10	Meeting 3
Weeks 12-13	Oral Exam