The Hong Kong University of Science and Technology

UG Course Syllabus

Fall 2026-2027

Math 4063 Functional Analysis

Credits: 3

Pre-requisite: (MATH 3043 OR MATH 4061) AND (MATH 2131 OR grade A- or above in MATH 2121)

Lecture

Time: Tuesday and Thursday 10:30-11:50

Venue: Room 1409, Lift 25-26

Name: Tianling JIN

Email: tianlingjin@ust.hk

Office Hours: by appointment in Room 3427

Tutorial

Time: Monday (18:00-18:50)

Venue: Room 1410, Lift 25-26

Name: Mengyu HUO

Email: mhuoaa@connect.ust.hk

Office Hours: to be announced in canvas

Course Description

This course covers several fundamental mathematical concepts in Functional Analysis, such as Hahn-Banach theorem, open mapping theorem, closed graph theorem, uniform boundedness theorem, separation theorem, Krein-Milman theorem, weak topologies, adjoints, duality, compact and Fredholm operators, spectral theorem for compact normal operators. It is a proof-based course. Students will learn rigorous mathematical definitions and theorems, and will learn how to write rigorous mathematical proofs.

Intended Learning Outcomes (ILOs)

By the end of this course, students should be able to:

1. Recognize and use appropriately rigorous mathematical definitions.

2. Write rigorous mathematical proofs.

3. Generalize practical problems to abstract mathematical settings.

4. Solve real and hypothetical problems by identifying the underlying mathematics and analyzing the problem.

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:

Assessment Task	Contribution to Overall Course grade (%)	Due date (if applicable)
Homework	5%	Will be announced in Canvas
Midterm	35%	TBD
Final Exam	60%	TBD

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
Homework	ILO1, ILO2, ILO3, ILO4	The homework assesses students' ability of understanding the concepts and the logic, distilling the abstract setting from examples, and applying the theory to other fields.
Midterm	ILO1, ILO2, ILO3, ILO4	The mid-term exam assesses students' ability of understanding the concepts and the logic, distilling the abstract setting from examples, and applying the theory to other fields.
Final Exam	ILO1, ILO2, ILO3, ILO4	The final exam assesses students' ability of understanding the concepts and the logic, distilling the abstract setting from examples, and applying the theory to other fields.

Grading Rubrics

Marks for each problem will be specified. Full marks will be awarded for completely correct answers. Partial credit will be given for answers that are on the right track but not fully complete.

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	The student has mastered almost all concepts and theories of functional analysis taught in the course, has excellent understanding of the deepest content of the subject, and acquired workable knowledge for further studies of partial differential equations.

B	Good Performance	The student has mastered most theories of functional analysis taught in the course, yet the understanding of some challenging concepts may not be deep enough for their applications on related advanced subjects.
C	Satisfactory Performance	The student meets the minimum expectation of the instructor, has acquired some basic computational techniques of the subject but only in finite dimensions, yet some concepts were not clearly understood.
D	Marginal Pass	The student is only able to recall some fragments of topics and is able to complete some of the easiest computations.
F	Fail	The student does not have sufficient understanding of even some fragments of topics, and is not even able to complete some of the easiest computations even in finite dimensions.

Course AI Policy

Students are allowed to consult any person (including the instructor, TA, classmates, friends outside HKUST) in any homework for ideas and hints, but are required to write up the solutions by themselves. You are required to **list the persons and references** you have consulted in every homework.

The use of ChatGPT or other generative AI is allowed, and they are regarded as "persons" you have consulted, and therefore must be listed in your homework.

However, please be warned that at the current stage of development of AI, the response to problems in advanced courses – especially those in pure mathematics – is not quite reliable. Students should be critical of the response generated by AI and do not blindly copy the generated responses to your homework.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include the wrong places. 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

Students should submit each homework in form of a clearly written and scanned or a LaTeX-typed PDF on the Canvas system before the deadline. No late homework is accepted. Resubmission is allowed before the deadline.

Required Texts and Materials

(1) *Functional Analysis, Sobolev Spaces and Partial Differential Equations* by Haim Brezis, which can be access on campus at https://link.springer.com/book/10.1007/978-0-387-70914-7

(2) Other reference: *Functional Analysis* By Jan van Neerven, which can be access at: https://arxiv.org/abs/2112.11166

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.