MATH 2043 – Honors Mathematical Analysis

Spring 2024 Course Outline

Lecture

Instructor:	**Prof. IP, Ivan Chi-Ho**
Office:	Room 3470 (Lift 25-26)
Office Hour:	By appointment
E-mail:	ivan.ip@ust.hk

Tutorial

TA:	**Hung, Kin Ting Ken**
Office:	Room 4381 (Lift 17–18)
Office Hours:	By appointment
E-mail:	ktkhung@connect.ust.hk

Meeting Time and Venue

Lecture:	Monday, Wednesday	09:00 – 10:20	LTH
T1A:	Wednesday	19:00 – 19:50	Room 4579, Lift 27–28

Course Description

The MATH 2043 and 3043 is a rigorous sequence in analysis on the line and higher dimensional Euclidean spaces. Limit, continuity, least upper bound axiom, open and closed sets, compactness, connectedness, differentiation, uniform convergence, and generalization to higher dimensions.

Prerequisite:	By instructor's approval or ARRO's pre-registration. Grade A- or above in MATH1024
Exclusion:	MATH2033
Credits:	4

Intended Learning Outcomes

Upon completion of this course, students are expected:

1. Develop an understanding of the core ideas and concepts of mathematical analysis for future studies in advanced courses.
2. Be familiar with the rigorous treatment of single and multi-variable functions; and
3. Be able to explain clearly concepts and reasonings from mathematical analysis.

Assessment Scheme

Choose a weight such that the total is 100%:

	Weight	Assessment ILOs
Homework	20%	1,2,3
Midterm Examination	10–50%	1,2,3
Final Examination	30–70%	1,2,3

The default weights are 20%, 30% and 50% respectively.

Grading Scheme

Letter grades will be assigned depending on overall performance.
Obtaining a total point of 90% or above, or top 10%, will guarantee an A+.
Obtaining a total point of 70% or above, or top 40%, will guarantee an A-range.
Obtaining a total point of 30% or above will guarantee a passing grade.

Teaching and Learning Activities

Aside from lectures, to master this course students are required to do as many exercises as they can to get familiar with the subject. A lot of the exercises are available in the references.

- There will be 5 homework sets during the semester, one set per Chapter of the lecture notes (or relevant materials)
- We will work through problems provided in Worksheet format during every lecture, part of them are Examples from the lecture notes.
- Tutorial Problem Sets will be discussed during the Tutorial Session. Solutions are available after each tutorial.

Student Learning Resources

Lecture Notes written by Prof. Frederick Fong.
Lecture Slides and **Lecture Videos** will be available on canvas after class.

Additional References:

1. *Advanced Analysis*, Lecture Notes by Prof. Min Yan
2. *Principles of Mathematical Analysis*, by W. Rudin
3. *Mathematical Analysis, 2nd Edition*, by T. Apostol

Tentative Schedule

Week 1 (half)	Review of Axiom of Completeness
Week 2	Dedekind Cuts, limsup, liminf
Week 3 (half)	Heine–Borel Theorem
Week 4	Uniform Continuity, Metric Spaces
Week 5	Point Set Topology, Compactness, Connectedness
Week 6	Baire Categoy Theorem
Week 7	Multivariable Calculus
Week 8	Inverse Function Theorem, Implicit Function Theorem
Week 9	Riemann Integrability Criterions, Lebesgue Integrability Criterions
Week 10	Riemann–Stieltjes Integration
Week 11	Uniform Convergence
Week 12	Exchange of Limits
Week 13 (half)	Arzelà-Ascoli Theorem
Week 14	Stone–Weierstrass Theorem