MATH 2043
Honors Mathematical Analysis
2021-22 Spring

https://canvas.ust.hk/courses/41781

Lecture

Time	Monday 3:00pm-4:20pm and Friday 10:30am-11:50am
Venue	Room 2406
Instructor	**Prof. Frederick Tsz-Ho FONG**
E-mail	frederick.fong@ust.hk
Office	Room 3488, Department of Mathematics

Tutorial

Time	Thursday 9:30am-10:20am
Venue	Room 1511
Teaching Assistant	**Jeff York YE**
E-mail	jyye@connect.ust.hk

Course Description

Course outline: It is the first part of a year-long honor course on real analysis targeted at mathematically mature undergraduate students. Topics include: supremum and infimum, completeness of real numbers, point-set topology of metric spaces, analysis of single-variable and multivariable functions, Riemann integrals, uniform convergence, etc.

Credits: 4

Prerequisites: Before taking this course, students should

- know what is limit (formal definition), and
- know your limit.

The course is only recommended for those who obtained B+ (preferably A-) or above in MATH 1023. Talented first year students, who excel in MATH 1023 and have workable knowledge of rigorous δ, ε-definition of limits, can consider taking this course in parallel with MATH 1024 after receiving the pre-requisite waiver approval in SIS. Students who took MATH 1014 (or got it waived by GCEAL/IB/AP exams) are NOT recommended to take this course unless they have already understood δ, ε-definition of limits well.

Intended Learning Outcomes (ILOs)

Upon completion of this course, students are expected to:

(1) build a strong background on mathematical analysis, on real line and on metric spaces, for future studies in advanced courses in mathematics, statistics, and related subjects;
(2) be familiar with the rigorous treatment of single-variable, multivariable functions, and functions on metric spaces; and
(3) develop logical reasoning and critical thinking skills.

Course Website

Canvas will be used as the course website. The link can be found on top of the page. Lecture notes, homework, solutions, and sample exams will be posted there. Students should visit the course website regularly to check up new announcements and new materials.

Student Learning Resources

Major Reference: Instructor's lecture notes posted on Canvas

Recommended References:

(1) *Principles of Mathematical Analysis* by Walter Rudin
(2) *Mathematical Analysis, 2nd Edition* by Tom Apostol
(3) Lecture notes written by Prof. YAN Min.

Grading

Homework: There will be about 5 problem sets. Students should submit each homework in form of a clearly scanned or LaTeX-typed PDF on the Canvas system before the deadline. The due time of Canvas is sharp. No late homework is accepted.

You can form a group of at most 3 students and submit the homework as a group. Every member in the same group will receive the same score.

Examinations: There will be a 3-hour midterm exam during Week 6-8 (exact date to be confirmed), and a 3-hour final exam arranged by ARRO.

Score Formula:

Total score

$$= \sup\{\lambda\,\text{homework} + \mu\,\text{midterm} + \nu\,\text{final} : \lambda \in [0, 0.2], \mu \in [0, 0.4], \nu \in [0.4, 0.7], \lambda + \mu + \nu = 1\}.$$

Grading Scheme: By absolute-scale. Try to aim at getting a total of 75% or above for an A range grade, and about 50% or above for an B range grade.

Tentative Schedule

Week #	Topics
1	Dedekind's cuts, supremum and infimum
2	Bolzano-Weierstrass's Theorem, Cauchy criterion
3	limit superior and inferior, Heine-Borel's Theorem
4	metric spaces
5	point-set topology on metric spaces
6	point-set topology on metric spaces, con't
7	differentiability of multivariable functions
8	Banach contraction mapping, inverse function theorem
9	higher-order differentiability, Riemann integrals
10	Riemann integrals, con't
11	Riemann-Lebesgue Theorem
12	Uniform convergence
13	Arzela-Ascoli's Theorem