THE CHINESE UNIVERSITY OF HONG KONG

Department of Mathematics

MATH3060 (Fall 2018)

Mathematical Analysis III

Lectures: W2 at LT4; F2,3 at C2, Tutorial W1 at LT4, Lady Shaw Building
Course Web Page : `http://www.math.cuhk.edu.hk/course/math3060/`

Backgroud

In our mathematics program, MATH1010, 1050, 2010, 2020, 2050, 2060 and 3060 provides a good foundation on analysis. After completing these courses, you are well-equipped for advanced courses. In particular, according to interest, you could choose among topology, real analysis, functional analysis, and Fourier analysis, etc.

Outline

There are three topics in this course– Fourier series, metric spaces, and the space of continuous functions divided into three chapters.

In the past, Fourier series was taught in Fourier analysis. However, in view of the important role of Fourier series plays in sciences and engineering, we believe that it should be learned by all math students. Now it is moved here so that at least all enrichment students could learn it. Those who are interested in Fourier series will learn more from MATH3093 Fourier Analysis. In fact, this subject belongs to the topic of series of functions covered in 2060. It has been postponed until now due to lack of time.

Metric space is a special but important type of topological spaces. In the past it was taught in topology. Again we believe metric space should be learned by all math majors and move it here. The contraction mapping principle on complete metric spaces enables us to provide proofs for two fundamental theorems, namely the implicit function theorem and the fundamental existence theorem for the Cauchy problem of differential equations. They were stated without proof in MATH2010 and MATH3270 respectively.

The space of continuous functions is perhaps the simplest infinite dimensional normed space (a special metric space). Two fundamental theorems, namely, the Arzela-Ascoli theorem and the Baire category theorem, will be discussed together with some applications. In MATH4010 Functional Analysis, one studies the general properties of normed spaces and linear operators. We hope to stimulate your interest in functional analysis through a case study on the space of continuous functions.

A thorough study on my lecture notes will be sufficient for this course. Materials for optional readings are for those who want to learn more. It is not intended for examination. Further references are suggested as we proceed, and they are for optional readings too.

Once again I would like to point out we not only need to READ mathematics, we need to DO mathematics. Try to go through as many exercises as you can. Don't just wait for the model answers.

Instructor

- Prof Kai-Seng Chou

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Teaching Assistants

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References

- *Fourier Analysis–An Introduction*, E.M. Stein and R. Shakarchi, Princeton Lectures in Analysis, Princeton 2002.
- *Metric Spaces*, E.T. Copson, Cambridge U Press, 1968.
- *Advanced Calculus*, 2nd ed., P.M. Fitzpatrick, Thomson Brooks/Cole, 2006.

Grade

- 15% Assignments
- 40% Midterm Examination
- 45% Final Examination