Backgroud

In our mathematics program, MATH1010, 1050, 2010, 2020, 2050, and 2060 are introductory courses on analysis. They are aimed to building up a solid foundation on this branch of mathematics. After completing these courses, our students are well-equipped for advanced courses. In particular, according to their interest, they could choose among topology, real analysis, functional analysis, and Fourier analysis, etc. Experiences in the past two decades tell us that there are rooms for improvement in our curriculum. Now changes become possible with the implementation of the new fourth-year curriculum. This course is introduced to cover those materials that are supposed to be of fundamental nature but have never been taught in the introductory courses before. In a single word, we fill up holes in this course. The content of this course is outlined below.

Outline

There are four topics in this course– Fourier series, metric spaces, the space of continuous functions and implicit/inverse function theorems.

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. As a consequence, it leaves three weeks for MATH3093 Fourier Analysis for going deeper. We suggest 4-yr curriculum students take Fourier Analysis in 2015/16 in order to avoid overlap in content.

Metric space is a special but important case of topological spaces. In the past it was taught in MATH3070 Introductory Topology. Again we believe metric space should be learned by all math majors and move it here. It is anticipated that more "genuine" topology, such as fundamental groups and homotopy, will be covered in Introductory Topology after this rearrangement.

The space of continuous functions is the first infinite dimensional normed space one encounters, and we know a lot about it. In MATH4010 Functional Analysis one studies the general properties of normed spaces and linear operators. Through a case study of the space of continuous functions, we hope to stimulate your interest in functional analysis.

Finally, the implicit and inverse function theorem were covered in MATH2010 Advance Calculus. Since this course is taken in your first or second year, you are not matured enough to learn the details of the proof. These theorems, which involve the principle of linearization, is extremely important in all mathematics. We plan to discuss them thoroughly here.

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References

- *Fourier Analysis–An Introduction*, E.M. Stein and R. Shakarchi, Princeton Lectures in Analysis, Princeton 2002.

- *Foundations of Modern Analysis*, J. Dieudonné, New York 1969.

- *Advanced Calculus*, 2nd ed., P.M. Fitzpatrick, Thomson Brooks/Cole, 2006.

Grade

- 10% Assignments

- 45% Midterm Examination ~~(October 16, 2014)~~ (October 15 (WED), 2014)

- 45% Final Examination (TBA)