Functional Analysis

MATH 36202 and MATH M6202

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Webpage: http://www.maths.bris.ac.uk/~mazag/functional_analysis/index.html

Class Times: Monday 11-12pm, Tuesday 12-1pm, Wednesday 11-12pm at SM4

Exercise Class: Wednesday 12-1pm every other week.

Office hours: Monday 10-11am, Wednesday 10-11am and by appointment.

Prerequisites: MATH 20200 Metric Spaces 2

Course Description: The unit aims to provide students with a firm grounding in the theory and techniques of Functional Analysis and to offer students ample opportunity to build on their problem-solving ability in this subject. It also aims to equip students with independent self-study and presentation-giving skills. This course sets out to explore some core notions in Functional Analysis which originated in the study of integral/differential equations and more generally equations for operators in infinite dimensional spaces. These techniques can be helpful, for instance, in analysing trigonometric series and can be used to make sense of the determinant of an infinite-dimensional matrix. Functional Analysis has found broad applicability in diverse areas of mathematics, physics, economics, and other sciences.

Students will be introduced to the theory of Banach and Hilbert spaces. The highlight of the course will be an exposition of the four fundamental theorems in the Functional Analysis (Hahn-Banach theorem, uniform boundedness theorem, open mapping theorem, closed graph theorem). The unit may also include some discussion of the spectral theory of linear operators.

Course Assessment: The final assessment mark for the unit is calculated from a standard 2.5-hour written closed-book examination in May-June 2015. Students on the level M unit will also have to write a short account of an additional topic and give a presentation on this topic. This counts towards 10% of the final mark and will be done in the last weeks of the teaching block. The exam consists of of FIVE questions. A candidate's best FOUR answers will be used for assessment. Calculators are NOT permitted in this examination. Raw scores on the examinations will be determined according to the marking scheme written on the examination paper. The marking scheme, indicating the maximum score per question, is a guide to the relative weighting of the questions. Raw scores are moderated as described in the Credit points are gained by either passing the examination (pass mark: 40), or getting a final assessment mark of 30 or over and making satisfactory attempts at at least three of the assigned homeworks.

References: The lectures will mostly follow Young's book (Ch. 1-8) and Kreyszig's book (Ch. 2-4). Most of this material can be also found in the other textbooks.

1. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, 1989.
2. D. Lax, Functional Analysis, Wiley lnterscience, New York, 2002.
3. W. Rudin, Functional Analysis, McGraw-Hill, 1991.
4. N. Young, An Introduction to Hilbert Space, Cambridge University Press, 1988.
5. R. Zimmer, Essential Results in Functional Analysis, University of Chicago Press, 1990.