MATH0110 Analysis for Joint Honours

Year:	2024{2025
Code:	MATH0110
Level:	4 (UG)
Normal student group(s):	First year students on BSc/MSci Mathematics and Statistical Science only
Value:	15 credits (= 7.5 ECTS credits)
Term:	1
Assessment:	The nal weighted mark for the module is given by: 70% Final examination, 15% coursework, 10% mid-sessional examination and 5% Proofs and Foundation coursework. In order to pass the module you must have at least 40% for both the nal examination mark and the overall weighted mark.
Normal Pre-requisites:	A* in A-level Mathematics and Further Mathematics
Lecturer:	Dr Beatriz Navarro Lameda

Course Description and Objectives

This module is an introduction to mathematical analysis, one of the most important and well-developed strands of pure mathematics with many elegant and beautiful theorems. The aim is to introduce students to the ideas of formal de nitions and rigorous proofs (one of the fundamental features of modern mathematics, and something that is not familiar from A-level), and to develop their powers of logical thinking. This module leads on to second and third year modules in mathematical analysis and related areas. It is intended for rst year students on the Mathematics and Statistical Science degree.

Recommended Texts

Haggarty, Fundamentals of Mathematical Analysis (2nd edition).
Other recommended books are
(i) Binmore, Introduction to Mathematical Analysis (CUP);
(ii) M. Spivak, Calculus (Publish or Perish);
(iii) R. Bartle and D. Sherbert, Introduction to Real Analysis (Wiley);
(iv) M H Protter and C B Morrey, A rst course in real analysis (Springer).

Detailed Syllabus

1. Brief Introduction to Logic and Sets of Real Numbers: quanti ers, bounded sets, supremum/in mum.

2. Sequences: convergence/limits, limit laws, sandwich theorem, boundedness, monotonicity.

3. Series, \telescopic" series, standard examples, tests of convergence.

4. Limits and continuity: sequential and de nition of limit, limit laws, sandwich theorem, limits and composition of functions, Intermediate Value Theorem, Extreme Value Theorem.

5. Di erentiability: de nition, di erentiation rules, examples of non-di erentiable functions

6. Mean Value Theorem: Mean Value Theorem, Rolle's Theorem, and theorems about monotonicity, extrema, and local extrema.

7. Integration: De nitions, elementary properties.

8. The Fundamental Theorem of Calculus.

9. Power series: radius of convergence, Taylor's formula, Taylor's series, power series as functions: di erentiability, standard power series (exponential function, $\sin x$; $\cos x$; $\sinh x$; $\cosh x$)