MATH0037 Logic

Year:	2021–2022
Code:	MATH0037
Level:	6 (UG)
Normal student group(s):	UG Year 3 Mathematics degrees
Value:	15 credits (= 7.5 ECTS credits)
Term:	2
Assessment:	90% examination, 10% coursework
Normal Pre-requisites:	MATH0006 (Algebra 2) and at least one of the following is recommended: MATH0028 (Combinatorial Optimisation) MATH0029 (Graph Theory and Combinatorics) MATH0034 (Number Theory) MATH0051 (Analysis 4: Real Analysis) MATH0052 (Geometry and Groups) MATH0053 (Algebra 4: Groups and Rings)
Lecturer:	Assoc Prof L Louder

Course Description and Objectives

This module is an introduction to propositional and first order logic. We study the interplay between semantic (truth, meaning) and syntactic (deductive) aspects of logic. The module has an emphasis on applications of ideas from logic in other areas of mathematics, mainly graph theory, combinatorics, and algebra.

Recommended Texts

The course aims to be self-contained, but the following texts may be useful:
- *Logic and Structure*, van Dalen
- *Mathematical Logic*, Chiswell and Hodges
- *Computability and Logic*, Boolos and Jeffrey
- *A Mathematical Introduction to Logic*, Enderton

Detailed Syllabus

Propositional Logic: The language of propositional logic. Propositional functions, truth values, valuations, compactness and applications. Rooted trees and Kőnig's lemma. The strengthened Ramsey theorem. Natural deduction.

First order Logic: Concrete examples of first order languages, theories, and their models, with particular emphasis on graphs, orders, Peano Arithmetic and other algebraic structures. Consistency and Godel's completeness theorem. Elementary equivalence. The Łoś-Vaught test. Non-standard models of arithmetic.

Basic Set Theory and Countability: Countable and uncountable sets. The Cantor-Schroeder-Bernstein theorem. Cantor's diagonalization argument. The theory of dense linear orders without endpoints.