MATH10111 - 2006/07

General Information

- Title: Sets, Numbers and Functions
- Unit code: MATH10111
- Credits: 15
- Prerequisites: A-Level Mathematics
- Co-requisite units: This course unit can only be taken with MATH10131 *Calculus and Vectors*
- School responsible: Mathematics
- Member of staff responsible: Prof. Peter Rowley

Specification

Aims

The aims of this course are to provide a basic introduction to various methods of proof used in mathematics and to the fundamental ideas in the study of sets, numbers and functions.

Brief Description of the unit

This lecture course is intended to introduce students to the concept of "proof". The objects of study, sets, numbers and functions, are basic to almost all Mathematics.

Learning Outcomes

On successful completion of this module students will be able to

- familiar with and able to manipulate the basic concepts of Pure Mathematics such as sets and functions;
- able to construct elementary proofs of mathematical statemens utilizing inductive arguments and arguments by contradiction;
- able to understand proofs of such results at the Fundamental Theorem of Arithmetic and the Euclidean Algorithm;
- familiar with the definitions and know some examples of groups and fields.

Future topics requiring this course unit

Almost all Mathematics course units, particularly those in pure mathematics.

Syllabus

1. Mathematical Logic. Propositions, predicates, logical connectives, truth tables. [3 lectures]
2. Proof by contradiction. Lots of examples. [2]
3. Induction proofs. Lots of examples. [4]
4. Set Theory. Sets, subsets, well known sets such as the integers, rational numbers, real numbers.Set Theoretic constructions such as unions, intersections, power sets, Cartesian products. [3]
5. Functions. Definition of functions,examples, injective and surjective functions, bijective functions, composition of functions, inverse functions. [3]
6. Counting. Counting of (mostly) finite sets, inclusion-exclusion principle, pigeonhole principle, binomial theorem. [3]
7. Euclidean Algorithm. Greatest common divisor,proof of the Euclidean Algorithm and some consequences, using the Algorithm. [3]
8. Congruence of Integers. Arithmetic properties of congruences,solving certain equations in integers. [3]
9. Relations. Examples of various relations,reflexive, symmetric and transitive relations. Equivalence relations and equivalence classes. Partitions. [3]
10. Some Number Theory. Fundamental theorem of Arithmetic, Fermat's little theorem. [2]
11. Binary Operations. Definition and examples of binary operations. Definition of groups and fields with examples. Proving that integers mod p (p a prime) give a finite field. [4]

Textbooks

The course is based on the following text:

P.J. Eccles, An Introduction to Mathematical Reasoning: Numbers, Sets and Functions, Cambridge University Press, 1997.

Notes will be issued for the material not covered in the course text.

Teaching and learning methods

Three lectures and one supervision class each week.

Assessment

Supervision attendance and participation; Weighting within unit 10%
Coursework; Weighting within unit 15%
Two and a half hours end of semester examination; Weighting within unit 75%

Arrangements