On-line course materials

MATH10111 - Sets, Numbers and Functions B

Year: 1 - **Semester:** 1 - **Credit Rating:** 15

Requisites

Corequisites
MATH10131 Calculus and Vectors B

Aims

TBA

Brief Description

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

- familiar with and able to manipulate the basic concepts of Pure Mathematics such as sets and functions;
- able to construct elementary proofs of mathematical statements 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.

Syllabus

- Mathematical Logic. Propositions, predicates, logical connectives, truth tables. [3 lectures]
- Proof by contradiction. Lots of examples.
- Induction proofs. Lots of examples.
- 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.

- Functions. Definition of functions,examples, injective and surjective functions, bijective functions, composition of functions, inverse functions.
- Counting. Counting of (mostly) finite sets, inclusion-exclusion principle, pigeonhole principle, binomial theorem.
- Euclidean Algorithm. Greatest common divisor,proof of the Euclidean Algorithm and some consequences, using the Algorithm.
- Congruence of Integers. Arithmetic properties of congruences,solving certain equations in integers.
- Relations. Examples of various relations,reflexive, symmetric and transitive relations. Equivalence relations and equivalence classes. Partitions.
- Some Number Theory. Fundamental theorem of Arithmetic, Fermat's little theorem.
- 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.

Teaching & Learning Process (Hours Allocated To)

Lectures	Tutorials/ Example Classes	Practical Work/ Laboratory	Private Study	Total
33	11	0	106	150

Assessment and Feedback

- Supervision attendance and participation; Weighting within unit 10%
- Coursework; In class test, weighting within unit 15%
- Two and a half hours end of semester examination; Weighting within unit 75%

Further Reading

The course is based on the following text:

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

Staff Involved

Dr Charles Eaton - Lecturer

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Back To Top