UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Matematica per l'Insegnamento - Algebra

2425-1-F0601Q096

Aims

The course “Matematica per l’insegnamento - Algebra” and his twin “Matematica per l’insegnamento - Geometria” are aimed at future teachers of mathematics and science. The aim of the course is to revisit in a rigorous way with proofs the mathematics of the elementary and secondary schools, with emphasis on the historical and didactical aspects.

Contents

1 - Elemetary logic

2 - Integral numbers

3 - Modular aritmetic

4 - Rational numbers, real numbers

5 - Polynomials

6 - Other rings

Detailed program

I. Elementary logic
1. Truth tables

2. Proofs
3. Sets
4. Functions
5. Equivalence relations
6. Natural numbers
7. Cardinality

II. Integers
1. Computations in Z
2. Divisibility
3. Prime numbers
4. p-adic valuation
5. Greatest Common Divisor and Least Common Multiple
6. The equation ax + by = c
7. Positional mumbering
8. Pythagorean triples

III. Modular arithmetic
1. Groups
2. Order
3. Rings
4. The congruence-class ring
5. The equation ax = b mod n
6. Chinese remainder theorem
7. Euler's function

IV. Rational and real numbers
1. Rational numbers
2. Base b expansion of rational numbers
3. Real numbers
4. Continued fractions

V. Polynomials
1. The ring of polynomials
2. Arithmetic of polynomials
3. Roots
4. Multiplicity
5. Polynomial interpolation

VI. Other rings
1. Complex numbers
2. Finite fields
3. Gaussian integers
4. Quaternions

Prerequisites

Background: Basic mathematics of the elementary and secondary schools. Prerequisites: None.

Teaching form

Classroom lectures. Individual and group study. The course is scheduled in Italian but could be held in English in the presence of foreign students.

Textbook and teaching resource

R.Courant, H.Robbins “What is mathematics? An elementary approach to ideas and methods”.

C.B.Boyer “A history of mathematics”.

G.Chrystal "Algebra: An elementary text-book".

Euclid “Elements”.

L.Euler “Elements of algebra”.

G.H.Hardy, E.M.Wright “An introduction to the theory of numbers”.

G.Polya "How to solve it".

G.Polya "Mathematics and plausible reasoning".

G.Polya "Mathematical discovery".

H.Steinhaus “Mathematical snapshots”.

J.Stillwell “Elements of Mathematics: From Euclid to Gödel”.

Notes of the Prof. Colzani.

Wikipedia.

Semester

Second semester.

Assessment method

Oral examination. The maximal grade is thirty. The student will have to demonstrate adequate understanding of the content of the course, and be able to expose clearly the knowledge acquired during the course.

Office hours

By appointment.

Sustainable Development Goals

QUALITY EDUCATION