



COURSE DESCRIPTION Real and Functional Analysis

SSD: ANALISI MATEMATICA (MAT/05)

DEGREE PROGRAMME: INGEGNERIA MATEMATICA (P17)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: MERCALDO ANNA
PHONE: 081-675679
EMAIL: anna.mercaldo@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 9

REQUIRED PRELIMINARY COURSES

.

PREREQUISITES

Mathematical Analysis at undergraduate level

LEARNING GOALS

The aim of this course is to provide students with basic knowledge of Real Analysis and Functional Analysis, particularly topics that are useful for the study of many other Mathematical Engineering courses.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must understand and show his knowledge of abstract real and functional analysis which is usually behind the methods used in the engineering and scientific problems.

Applying knowledge and understanding

The course gives the basic real and functional analysis tools for solving simple theoretical problems as well as problems arising in the applications and faced in the other courses.

COURSE CONTENT/SYLLABUS

Topological spaces. Metric spaces. Completeness. Compactness. Complete metric spaces: Banach spaces, Hilbert spaces. Orthonormal basis and Fourier series in Hilbert spaces. Linear and continuous operators between normed spaces. Compact operators. Adjoint operators. Spectral decomposition of self-adjoint operators. Spectrum of Laplace operator. Weak topologies. Reflexive spaces. Separable spaces. L^p spaces. Sobolev spaces and variational formulation of boundary value problems for partial differential equations. Introduction to Galerkin methods and finite elements methods in a model case.

READINGS/BIBLIOGRAPHY

- [1] H. Brezis, Functional Analysis, Sobolev spaces and Partial Differential Equations. Springer (2011).
- [2] A. Ferrero, F. Gazzola, M. Zanotti, Elements of advanced mathematical analysis for physics and engineering, Ed. Esculapio
- [3] E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley and Sons (1989).
- [4] A. Mercaldo, Notes on Real and Functional Analysis, see "Materiale didattico"
- [5] W. Rudin, Functional analysis. McGraw Hill, Inc., New York, 1991
- [6] S. Salsa, Equazioni a derivate parziali. Metodi, modelli e applicazioni. Springer

TEACHING METHODS OF THE COURSE (OR MODULE)

Lessons and training in presence.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

Written

Oral

- Project discussion
- Other : Tests in itinere and/or oral

In case of a written exam, questions refer to

- Multiple choice answers
- Open answers
- Numerical exercises

b) Evaluation pattern

The grade is formulated by the Examination Commission depending on the answers provided by the student the questions that have been formulated. The final grade is also motivated to the student.