



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Functional Analysis

1920-1-F5302Q002

Aims

The aim of the course is to provide the basic tools of Mathematical Analysis useful in the study of the differential equations of Classical Physics and Quantum Mechanics

Contents

Complex analysis. Fourier series. Convolution. Fourier transform. Distributions and Dirac delta. Elements of Calculus of Variations.

Detailed program

Complex Analysis

Holomorphic functions and harmonic functions. Cauchy's theorem. Laurent series. Residue theorem. Jordan Lemma. Calculation of integrals by means of residue theorem.

Fourier series.

Reminder on series expansion. Complete orthonormal systems. Parseval formula and inversion formula. Fourier series in real and complex form.

Fourier transform and applications.

Parseval formula and inversion formula. Convolution of functions. Applications to the resolution of the heat, wave

and Schroedinger equation. Calculation of Fourier transforms with the residue theorem. Gaussian function. Lorentzian function. Voigt function.

Distributions.

Definition and simple properties. Approximation of the Dirac delta distribution.

Elements of Calculus of Variations.

Functional derivative. Euler-Lagrange equation. Estimation of eigenvalues.

Prerequisites

Basic mathematical analysis: differential calculus for functions of one or several variables, ordinary and partial differential equations, integral calculus.

Teaching form

Lectures and exercises.

Textbook and teaching resource

K. F. Riley, M. P. Hobson and S. J. Bence. *Mathematical Methods for Physics and Engineering*, Cambridge University Press.

Further material will be suggested or distributed during the course.

Semester

First Semester 2019-20

Assessment method

Written exam: exercises and problems with open questions.

Oral exam: discussion of the written exam; solution of further exercises can be required; questions on definitions, statements and (selected) proofs of theorems.

It is possible to take the oral exam even if the result of the written exam is not sufficient.

Office hours

By appointment, sending an e-mail to giona.veronelli@unimib.it
