



Programme of Integrated course "Advanced Analysis"

This course is composed of 2 Modules: 1) Advanced Analysis 1, 2) Advanced Analysis 2

- Code: DT0114
- Type of course unit: Compulsory (Master Degree in Mathematics curriculum Generale), Compulsory (Master Degree in Mathematical Engineering curriculum Comune)
- Level of course unit: Postgraduate Degrees
- Semester: 1

Number of ects credits: (Master Degree in Mathematics) 6 (workload 150 hours), (Master Degree in Mathematical Engineering) 6 (workload 150 hours)

Teachers: Corrado Lattanzio

- 1 Course objectives** Knowledge of mathematical methods that are widely used by researchers in the area of Applied Mathematics, as Sobolev Spaces, distributions. Application of this knowledge to a variety of topics, including the basic equations of mathematical physics and some current research topics about linear and nonlinear partial differential equations.
- 3 Course prerequisites** Basic notions of functional analysis, functions of complex values, standard properties of classical solutions of semilinear first order equations, heat equation, wave equation, Laplace and Poisson's equations.
- 4 Teaching methods and language** Lectures
Language: English
Reference textbooks
 - G. Gilardi, *Analisi 3*. McGraw-Hill.
 - V.S. Vladimirov, *Equations of Mathematical Physics*. Marcel Dekker, Inc..
 - C.M. Dafermos, *Hyperbolic Conservation Laws in Continuum Physics*. Springer.
 - L.C. Evans, *Partial Differential Equations*. AMS.
 - M.E. Taylor, *Partial Differential Equations, Nonlinear equations*. Springer.
 - H. Brezis, *Sobolev Spaces and Partial Differential Equations*. Springer.
- 5 Assessment methods** Oral exam

Programme of Module "Advanced Analysis 2"

- Code: DT0115
- Type of course unit: Compulsory (Master Degree in Mathematics curriculum Generale)
- Level of course unit: Postgraduate Degrees
- Semester: 2

Number of ects credits: (Master Degree in Mathematics) 6 (workload 150 hours)

Teachers: Stefano Spirito (stefano.spirito@univaq.it)

- 1 Course objectives** Aim of the course is the knowledge of advanced techniques of mathematical analysis and in particular the basic techniques of the modern theory of the partial differential equations.
- 2 Course content and learning outcomes (dublin descriptors)** Topics of the module include:
 - Abstract Measure theory
 - AC and BV functions.
 - Second order elliptic equations.
 - Variational methods.
 - Fourier transforms.
On successful completion of this module, the student should :
 - Aim of the course is to acquire Knowledge and Understanding of Advanced Techniques of 'Mathematical Analysis.
 - applying the techniques learned to problems of partial differential equations
 - Acquire the ability to understand what methods and techniques can be used in

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| | | <p>various problems involving the partial differential equations.</p> <ul style="list-style-type: none"> • Acquire the ability 'to expose, explain and elaborate concepts and advanced analysis techniques. • Acquire the ability 'to study and understand theorems and analysis techniques from books and advanced research products. |
| 3 | Course prerequisites | A good knowledge of the basic arguments of a course of Functional Analysis, in particular, a good knowledge of the theory of Lebesgue's integral and the L^p spaces. The first module of the course, in particular a good knowledge of the theory of distributions and Sobolev spaces. |
| 4 | Teaching methods and language | <p>Lectures.</p> <p>Language: English</p> <p>Reference textbooks</p> <ul style="list-style-type: none"> • L. Grafakos, <i>Classical Fourier Analysis</i> . • P. Cannarsa and T. D'aprile, <i>Introduction to Measure Theory and Functional Analysis</i> . • L. Evand and R. Garipey, <i>Measure Theory and Fine Properties of Functions (Revised Edition)</i>. • L.C. Evans, <i>Partial differential equations</i>. |
| 5 | Assessment methods | Written exams. |