Università degli Studi di L'Aquila - Dipartimento di Ingegneria e Scienze dell'Informazione e Matematica

Course catalogue

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Programme of Integrated course "Istituzioni Di Analisi Superiore "

This course is composed of 2 Modules: 1) Complex analysis (Istituzioni di Analisi Superiore mod. 2), 2) Analisi Funzionale (Istituzioni di Analisi Superiore mod.1)

Programme of Module "Complex analysis (Istituzioni di Analisi Superiore mod. 2)"

- Code: DT0027
- Type of course unit: Compulsory (Bachelor Degree in Mathematics curriculum Generale)
- Level of course unit: Undergraduate Degrees
- Semester: 2

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

Teachers: Margherita Nolasco (nolasco@univaq.it)

1	**Course objectives**	Knowledge of basic topics of complex analysis: elementary functions of complex variable, differentiation, integration and main theorems on analytic functions . Ability to use such knowledge in solving problems and exercises
2	**Course content and learning outcomes (dublin descriptors)**	Topics of the module include: • Complex numbers. Sequences. Elementary functions of complex numbers. Limits, continuity. Differentiation. Analytic functions. Armonic functions • Contour integrals. Cauchy's Theorem. Cauchy's integral formula. Maximum modulus theorem. Liouville's theorem. Morera theorem. • Series representation of analytic functions. Taylor's theorem. Laurent's series and classification of singularities • Calculus of residues. The residue theorem. Application in evaluation of integrals on the real line and Principal Value. The logarithmic residue, Rouche's theorem. • Fourier transform for L^1 functions. Applications. Fourier transform for L^2 functions. Plancherel theorem. • Laplace transform and applications.
3	**Course prerequisites**	Knowledge of all topics treated the Mathematical Analysis courses in the first and second year : real function of real variables, limits, differentiation, integration; sequences and series of funcions; ordinary differential equations
4	**Teaching methodsand language**	theoretical lectures and exercises **Language**: English **Reference textbooks** • J.E. Marsden, M.J. Hoffman, ***Basic complex analysis***. Freeman New York. • W. Rudin, ***Real and complex analysis***. Mc Graw Hill.
5	**Assessment methods**	Written exam and oral exam

Programme of Module "Analisi Funzionale (Istituzioni di Analisi Superiore mod.1)"

- Code: DT0026
- Type of course unit: Compulsory (Bachelor Degree in Mathematics curriculum Generale)
- Level of course unit: Undergraduate Degrees
- Semester: 1

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

Teachers: Margherita Nolasco (nolasco@univaq.it)

1	**Course objectives**	Learn the fundamental structures of Functional Analysis. Get familiar with the main examples of functional spaces, in particular with the theory of Hilbert spaces and Lebesgue spaces. Get familiar with the basic notions of operator theory. Be able to frame a functional equation in an abstract functional setting.
2	**Course content and learning outcomes (dublin descriptors)**	Topics of the module include: • Lebesgue Measure and Integration • L^p Spaces • Basic of Topological Vector Spaces, Normed and Banach Spaces, Linear Operators

		and linear functionals. • Hilbert Spaces • Weak topology, Weak * topology, weak compactness • Applications of Baire Category in Functional Analysis: Uniform Boundedness, Open Mapping, Closed Graph, Inverse Mapping. • Banach and Hilbert adjointness, self-adjointness • Compact Operators • Riesz Fredholm spectral theory On successful completion of this module, the student should : • Understand the theory • Be able to solve problems • Help to choose appropriate graduate studies • Practice mathematical reasoning, organize topics in logical order, connect theory to applications, elaborate independent proofs. Improve unconventional thinking. • Get the math language to study more advanced textbooks and attend research oriented courses
3	**Course prerequisites**	Mathematical Analysis (not only Calculus) in one and several space variable, Linear Algebra (including abstract Vector Speces), Set Topology (including Compact Spaces) and Metric Spaces, Ordinary differential equations.
4	**Teaching methodsand language**	Classical traditional XX century blackboard teaching (no fancy modern technology) **Language**: Italian **Reference textbooks** • Haim Brezis, ***Functional analysis, Sobolev spaces and partial differential equations.***. Universitext. Springer, New York,. 2011. • E. Kreyszig, ***Introductory Functional Analysis with applications***. Wiley. 1978. • R.L. Wheeden A. Zygmund, ***Measure and Integral***. CRC Press,. 1977. • M. Reed, B.Simon, ***Methods of modern mathematical physics. I. Functional analysis. Second edition.*** . Academic Press, New York,. 1980. • W. Rudin, ***Real and complex analysis.***. Mc Graw Hill. .
5	**Assessment methods**	Written test.