



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

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| <ul style="list-style-type: none"> <li>• Code: DT0026</li> <li>• Type of course unit: Compulsory (Bachelor Degree in Mathematics curriculum Generale)</li> <li>• Level of course unit: Undergraduate Degrees</li> <li>• Semester: 1</li> </ul> |  |  |
| Number of ects credits: (Bachelor Degree in Mathematics) 6 (workload 150 hours)  |  |  |
| Teachers: Margherita Nolasco (nolasco@univaq.it)   |  |  |
| 1  | <b>Course objectives</b>   | 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  | <b>Course content and learning outcomes (dublin descriptors)</b> | <p>Topics of the module include:</p> <ul style="list-style-type: none"> <li>• Lebesgue Measure and Integration</li> <li>• <math>L^p</math> Spaces</li> <li>• Basic of Topological Vector Spaces, Normed and Banach Spaces, Linear Operators and linear functionals.</li> <li>• Hilbert Spaces</li> <li>• Weak topology, Weak * topology, weak compactness</li> <li>• Applications of Baire Category in Functional Analysis: Uniform Boundedness, Open Mapping, Closed Graph, Inverse Mapping.</li> <li>• Banach and Hilbert adjointness, self-adjointness</li> <li>• Compact Operators</li> <li>• Riesz Fredholm spectral theory</li> </ul> <p>On successful completion of this module, the student should :</p> <ul style="list-style-type: none"> <li>• Understand the theory</li> <li>• Be able to solve problems</li> <li>• Help to choose appropriate graduate studies</li> <li>• Practice mathematical reasoning, organize topics in logical order, connect theory to applications, elaborate independent proofs. Improve unconventional thinking.</li> <li>• Get the math language to study more advanced textbooks and attend research oriented courses</li> </ul> |
| 3  | <b>Course prerequisites</b>                                      | Mathematical Analysis (not only Calculus) in one and several space variable, Linear Algebra (including abstract Vector Spaces), Set Topology (including Compact Spaces) and Metric Spaces, Ordinary differential equations.  |
| 4  | <b>Teaching methods and language</b>                             | <p>Classical traditional XX century blackboard teaching (no fancy modern technology)</p> <p><b>Language:</b> Italian</p> <p><b>Reference textbooks</b></p> <ul style="list-style-type: none"> <li>• Haim Brezis, <b>Functional analysis, Sobolev spaces and partial differential equations</b>.. Universitext. Springer, New York,. 2011.</li> <li>• E. Kreyszig, <b>Introductory Functional Analysis with applications</b>. Wiley. 1978.</li> <li>• R.L. Wheeden A. Zygmund, <b>Measure and Integral</b>. CRC Press,. 1977.</li> <li>• M. Reed, B.Simon, <b>Methods of modern mathematical physics. I. Functional analysis. Second edition</b>. . Academic Press, New York,. 1980.</li> <li>• W. Rudin, <b>Real and complex analysis</b>.. Mc Graw Hill. .</li> </ul>   |
| 5  | <b>Assessment methods</b>  | Written test.  |