Academic subject: FRACTAL THEORY				
Degree Class: LM-40		**Degree Course:** Mathematics	**Academic Year:** 2018/2019	
		Kind of class: optional	**Year:** 1	**Period:** 2
			ECTS: 7 divided into **ECTS lessons:** **6,5** **ECTS** **exe/lab/tutor: 0,5**	

Time management, hours, in–class study hours, out–of–class study hours
lesson:52
 exe/lab/tutor:8
in–class study:60
out–of–class study: 115

Language: Italian	Compulsory Attendance: no		
Docente: Sandra Lucente Marcello D'Abbicco	**Tel:** Sandra Lucente 0805442275 Marcello D'Abbicco 0805442721 **e-mail:** sandra.lucente@dm.uniba.it marcello.dabbicco@dm.uniba.it	**Ricevimento** **studenti:** Dip. Matematica Sandra Lucente Piano II Stanza 22 Marcello D'Abbicco Piano II Stanza 36	**Giorni e ore** **ricevimento:** previo appuntamento

Prerequisites:
Mathematical Analysis in one and more variables, Early Ressources of Complex Analysis, General Topology. This notiaons are common to students after two years of Bachelor Mathematics L-35

Educational objectives:
Knowledge of the measure of Hausdoorf; acquisition of Hausdoorf box-counting and topological dimensions comparison of such notions; IFS and Mandelbrot and Julia fractals

Expected learning outcomes (according to Dublin Descriptors)	**Knowledge and understanding:** Acquire fundamental concepts and demonstrative techniques of the fractal theory. **Applying knowledge and understanding:** Ability to calculate some mesure and dimensions of sets. Capacity to build some recursive fractals and implement them in a computer environment. Ability to relate the results studied with applications to geology, biology, medicine, etc. **Making judgements:** Ability to identify the right mathematical tools and the right techniques to deal with complex mathematical problems. **Communication:** Acquiring advanced mathematical language and mathematical formalism, necessary for the consultation and understanding of articles. Competences in Italian and English communication in mathematical language and formalism; computer skills in relation to the simple processing of fractals; ability to work in groups; the ability to divulge the relationship between fractals and the natural or anthropic world. Capacity to display the studied results for the description, analysis and resolution of some problems of chaos theory

	Lifelong learning skills: Acquisition of an appropriate study method supported by textbook and i computer programs for the construction of fractals

Course program

Analytical Theory Hausdorff Measure • Hausdorff dimension • Boxcounting dimension • Curve Length • Area Formula

Geometric Theory • Small Inductive dimension • Large Inductive dimension • Covering dimension • Equivalence in Definitions • Brower's Point Theorem and Euclidean Space Dimensions •

Fractal sets • Definition of fractal sets • IFS fractals • Application of the analytical and geometric theory of dimension to Cantor type sets, ultrametric space, Van Koch curve, Sierpinsky, Menger, Apollonius sets • Application to filling curves in particular Peano and Hilbert curves • Mandelbrot, Julia and Fatou Sets.

Applications Graphic methods for calculating the fractal dimension • Graphing methods for representation of fractal sets • Fractal applications in various disciplines

Teaching methods:
Classroom lessons

Auxiliary teaching:
For more complex lessons we give to students lecture notes few days before.

Assessment methods:
A talk starting from scientific articles on fractals.

Bibliography:
Falconer, Kenneth. *Fractal geometry: mathematical foundations and applications*. John Wiley & Sons, 2004.
Edgar, Gerald. *Measure, topology, and fractal geometry*. Springer Science & Business Media, 2007