Academic subject: Integral Geometry				
Degree Class: LM-40-Matematica		**Gradduate school:** Mathematics	**Academic Year:** 2017/2018	
		Kind of class: (<mark>inserire</mark> mandatory or optional)	**Year:**	**Period:** 2
		optional	**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
<mark>Frontal</mark> lesson: 52   exe/lab/tutor: 8   in–class study: 60   out–of–class study: 115

Language: Italian	**Compulsory Attendance:** no	

Subject Teacher: Grazia Raguso	**Tel:** 0805442682 **e-mail**: grazia.raguso@uniba.it	**Office:** Department of Mathematics Room 2 , Floor III	**Office days and hours:** Thursday 8-10. Other days and times by appointment.

Prerequisites:
Mathematical knowledge which usually is acquired during L-35 course.

Educational objectives:
Ability to identify and apply to concrete problems the most relevant knowledge acquired during the three-year of degree L-35 course

Expected learning outcomes (according to Dublin Descriptors)	**Knowledge and understanding:** Acquisition of fundamental concepts of Classical Groups, of Fractal Geometry, of dynamic systems and the link among them. **Applying knowledge and understanding:** Ability to use and transfer the theoretical notions acquired into more complex math and other sciences problems. **Making judgements:** Ability to evaluate the consistency of the logical reasoning used in a demonstration. Ability to identify the right math tools to deal with complex math problems. **Communication:** Ability to use correct, appropriate, and clear language to effectively communicate the notions acquired **Lifelong learning skills:** Acquisition of an appropriate study method by consulting the texts and resolving the exercises proposed by the course.

Course program

1 Matrix Groups. The vector space of the matrices Mn, m. Linear group $GL_n(K)$. Special linear group $SL_n(K)$. Metric Structure on $M_n(K)$. Groups of matrices as metric spaces.
Definition of topological group. Examples: $GL_n(K)$ group, group $SL_n(K)$. K-matrix group.
Definition of K-matrix group. Fundamental example: $SL_n(K)$ group as a K-matrix group. The $GL_n(K)$ and $SL_n(K)$ groups as subgroups of $GL_{n+1}(K)$ matrices. Study of the connection of a K-matrix group (decomposition).
Borel Group and Unipotent Group as K-matrix groups. Affine Group, Isometry Group, Orthogonal Group, property and decomposition. Generalized Orthogonal Group. Special cases: generalized orthogonal group defined by a matrix, Q, symmetric with signature (p, q). Called on the Quadratic form associated with Q. Form of Lorentz and Minkowsky's form. Groups of Lorentz.

2. Elementary theory of Fractal Geometry. Background. Fractals in Mathematics, Cantor's set and its properties. Curve of Von Koch and its properties. The sets of Mandelbrot and Julia. Fractal dimension, Ruler method (or compass method) and box-counting method. Autosimilarity dimension. Called on the Hausdorff measures and Hausdorff dimension. The link between Hausdorff's dimension and the self-similarity dimension.

Calculation the fractal dimension of fractal figures.

3. Elementary theory of Dynamic Systems. Complexity, chaos and continuous and discrete dynamic systems. Group to a parameter.. Cauchy's Problems and dynamic systems. Phase space, expanded phase space, phase trajectories, and phase portraits. Hyperbolic and non-hyperbolic equilibrium points. Classification of hyperbolic equilibrium points. Examples of linear/no linear dynamic systems. Geometric study of phase portrait.
Study of the Malthus model and the Verhulst model (logistic). Definition of Lyapunov-stability and dynamic bifurcation points. Examples.

Teaching methods:
Lectures and exercise sessions

Auxiliary teaching:
Suggested texts and notes available in the classroom

Assessment methods:
Oral exam

Bibliography:

☐☐Georgescu, L. Palese, G. Raguso, Biomatematica, Cacucci Editore, Bari;
☐☐Andrew Baker, Matrix group, Sprinter;
☐☐A. Georgescu, M. Moroianu, L. Oprea, "Teoria Bifurcatiei", Editura Universitătii din Pitesti;
☐☐L. Peccati, S. Salsa, A. Squellati, "Matematica per l' Economia e l'Azienda", Egea;
☐☐H. O. Peitgen, P. H. Richter, "La Bellezza dei Frattali", Ed. Bollati Boringhieri;
☐☐D. Benedetto, M. Degli Espositi, C. Maffei, "Matematiche per le Scienze della vita" Casa Editrice Ambrosiana.