COURSE: Geometry 2			
ACADEMIC YEAR: 2017/18			
TYPE OF EDUCATIONAL ACTIVITY: Characterizing			
TEACHER: Prof. Martin Funk			
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Language: Italian			

ECTS: 15 credits	n. of hours: 120 (60 lessons, 60 tutorials/practice)	Campus: Potenza Dept: DiMIE Program: Mathematics	Semester: annual

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course aims to supply an adequate basic knowledge in projective, (non-)Euclidean, and differential geometry, and in topology: the main topic of the course is the study of various models of 2-dimensional geometry in 3-space.

The principal knowledge students should achieve is articulated as follows:
o elements of projective geometry and general topology;
o introduction to methods used in differential geometry;
o fundamentals of Klein's point of view for the comparative study of Euclidean geometry and non-Euclidean geometries;
o classification of closed compact connected surfaces;
o elements of differential geometry for the study of curves and 2-dimensional surfaces in 3-space.

The principal abilities students should achieve are:
o to use the projective language in wording geometric problems;
o to recognize (non-) Euclidean geometry by analyzing the elliptic, parabolic or hyperbolic measurement of distances and angles;
o to analyze properties of closed compact connected surfaces;
o to discuss properties of curves in 3-space by analyzing curvature and torsion;
o to discuss properties of surfaces by analyzing their principal curvatures.

PRE-REQUIREMENTS

Students are supposed to have achieved the following knowledge from the courses "Algebra", "Mathematical Analysis 1" and "Geometry 1":
o elements of group theory;
o elements of Euclidean geometry, in particular concerning Euclidean motions (translations, rotations, reflections);
o differential calculus of real functions of several variables.

SYLLABUS

Projective and (non-) Euclidean Geometry (18 hours + 24 hours of exercises):
1. Projective spaces, co-ordinate systems and homogeneous co-ordinates, change of co-ordinate systems and collineations, polarities, (algebraic, Steiner, and Staudt) conics, Desagues' and Pappos' configurational theorems.
2. Subgroup of collineations fixing a conic, Laguerre's theorem.
3. Klein's point of view: Euclidean and hyperbolic geometry, the group of (rigid) motions in both geometries, (elliptic, parabolic, and hyperbolic) measure of angles and distances, properties shared by both geometries (flagtransitivity, concurrence of bisectors in a triangle), properties not shared by Euclidean and hyperbolic geometry (parallelism, sum of angles in a triangle).
4. Beltrami's and Poincare's conform models.

Topology (24 hours + 12 hours of exercises):
1. Topological spaces, subspaces, product and quotient spaces; examples of
topologies (discrete, co-finite, natural metric, Zariski's topology), adherent and
accumulation points, closure, axioms of separation, continuous mappings,
homeomorphisms; compact and connected spaces.
2. Classification of connected compact (non-)orientable surfaces.

Differential Geometry (18 hours + 24 hours of exercises):
1. Real curves and surfaces, vector fields, tangent space, vector fields on surfaces and orientation.
2. Shape operator, curvature of surfaces, parametric representations of curves and surfaces.
3. Frenet's formulae for curves in real 3-space.

TEACHING METHODS
The course is articulated in 120 hours of teaching: i.e. 60 hours of theoretical lessons and 60 hours of classroom tutorials.

EVALUATION METHODS
The final assessment considers the students' achievements concerning the educational goals listed above. Both knowledge and linguistic accuracy are subjects of evaluation. The final assessment is organized as an oral examination, divided into three parts (projective and (non-) Euclidean geometry, general topology and differential geometry), 25 minutes each, which can be done together or in different days. The votes of the three parts are expressed in 30th and the final vote is the arithmetic mean of the single votes.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL
Teacher's Lecture Notes: Descriptive Geometry is All Geometry"
Text books:
o Sernesi: Geometria II
o Tallini: Strutture geometriche
o Thorpe: Elementary Topics in Differential Geometry

Further reading:
o Gray: Modern Differential Geometry of Curves and Surfaces
o Yaglom: A Simple Non-Euclidean Geometry and its Physical Basis

INTERACTION WITH STUDENTS
At the beginning of the course, the teacher explains goals and methods of the course and distributes his Lecture Notes.
Students are received each Friday from 11 a.m. to 1 p.m. (as well as on appointments taken by e-mail) at the teacher's office (Room n. 53 of the Dept. DiMIE).

EXAMINATION SESSIONS (FORECAST)[1]
26-Jan-2018, 23-Feb-2018, 30-Mar-2018, 27-Apr-2018, 25-May-2018, 29-Jun-2018, 20-Jul-2018, 28-Sep-2018, 26-Oct-/2018, 23-Nov-2018.

SEMINARS BY EXTERNAL EXPERTS   YES □   NO X

FURTHER INFORMATION

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[1] Subject to possible changes: check the web site of the Teacher or the Department/School for updates.