COURSE DATA

Data Subject	
Code	34165
Name	Classical differential geometrics
Cycle	Grade
ECTS Credits	12.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1107 - Degree in Mathematics	Faculty of Mathematics	3	Annual

Subject-matter

Degree	Subject-matter	Character
1107 - Degree in Mathematics	9 - Topology and differential geometry	Obligatory

Coordination

Name	Department
BELTRAN SOLSONA, JOSE VICENTE	363 - Mathematics
CARRERAS MARTINEZ, FRANCISCO	363 - Mathematics

SUMMARY

The general aim of this course is to introduce the concepts, methods and basic results of differential geometry, with special emphasis on classical geometry of curves and surfaces, and a light introduction to the concept of abstract differentiable manifold.

Primarily, it is to study low-dimensional geometric objects, curves and surfaces of Euclidean space, that support locally, a linear approximation.

This allows relating the right tool for the study and development of concepts is the differential calculus, and, almost as a consequence, linear algebra and topology.

At the end of some lessons about abstract manifolds as natural extensions to other dimensions apparently without ambient space are introduced.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Students must have completed courses of Linear Algebra I and Geometry, Mathematical Analysis I and II, Ordinary Differential Equations and Topology. It is absolutely necessary that all have passed, although it is convenient.

OUTCOMES

1107 - Degree in Mathematics

- Capacity for analysis and synthesis.
- Solve problems that require the use of mathematical tools.
- Ability to work in teams.
- Learn autonomously.
- Possess and understand the mathematical knowledge.
- Expressing mathematically in a rigorous and clear manner.
- Reason logically and identify errors in the procedures.
- Capacity of abstraction and modeling.
- Knowing the time and the historical context in which occurred the great contributions of women and men in the development of mathematics.
- Visualize and interpret the solutions obtained.

LEARNING OUTCOMES

Develop the ability to interact with imagination formal expression.

Distinguish rigor and intuition to take advantage of the relationships between them.

Developing spatial vision.

Learn to mix with deductive arguments calculation.

DESCRIPTION OF CONTENTS

1. Curves

- Curves in the plane and in space
- Curvature and torsion. Frenet frame.
- Fundamental Theorem of the theory of curves

2. Surfaces

- Surfaces in R^3. Definition. Parameterization. Tangent plane.
- First fundamental form. Area of a parameterized surface.

3. Extrinsic local geometry

- The Gauss mpa. The Weingarten map. Second fundamental form.
- Variation of the area and minimal surfaces.

4. Intrinsic local geometry

- The Gauss' egregium theorem.
- Covariant derivative.
- Parallel transport.
- Geodesics.
- The Gauss-Bonnet theorem

5. Differentiable manifolds

- Abstract differentiable manifold.
- Vector fields on a manifold.
- Basic examples: the sphere, the real projective space, the topological torus and the products of these spaces.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	75,00	100
Classroom practices	45,00	100
Other activities	15,00	100
Development of group work	25,00	0
Preparation of evaluation activities	25,00	0
Preparing lectures	70,00	0
Preparation of practical classes and problem	60,00	0
TOTAL	**315,00**	

TEACHING METHODOLOGY

The theoretical part takes place in master classes where the contents will be gradually introduced and the mathematical method. On each topic, and related theoretical knowledge, many examples are included, as well as resolving problems of the type own theme. And at the end of each topic lists will be provided exercises to be solved by the students.
Contact hours of theoretical explanation: 60
Internship Contact hours: 45
Tutored face seminars and evaluation of collections of problems: 15
The corresponding 120 contact hours are distributed as follows:
2 hour theory, and 1.5 hours each week problems.
5 sessions of 1.5 hours per semester for seminars / assessment practices.

EVALUATION

There will be a control examination in December and another in June. The student may choose to make only one or two controls in June. The note of these controls will score 80% of the course.

Students, which, in small groups, solve problems set in advance in the seminar sessions and evaluation of collections will be asked. These problems score about 20% of the final grade.

To pass the course will need to get at least 4 out of 10 in the average grade of the controls.

To make the average between the notes of the controls they should be greater than or equal to 4 out of 10.

REFERENCES

Basic

- Referencia b1: Do Carmo. "Geometría Diferencial de Curvas y Superficies", Alianza Editorial.

  Referencia b2: Wolfgang Kühnel: "Differential Geometry. Curves-Surfaces-Manifolds", Second Edition, AMS, 2005.

  Referencia b3: Bennis Barden y Charles Thomas: "An Introduction to Differential Manifolds" Imperial College Press, 2005.

  Referencia b4: N. Hicks: "Notas sobre Geometría Diferencial" Editorial Hispano-Europea.

Additional

- Referencia c1: Juan Luis Monterde: "Geometria Diferencial Clàssica" http://www.uv.es/monterde/pdfs/totGDC.pdf

  Referencia c2: Vicente Miquel: "Apuntes de Geometría III" http://www.uv.es/~miquel/Papers/ApuntesGeometriaIII

  Referencia c3: Alfred Gray, Elsa Abbena, Simon Salamon: "Modern Differential Geometry of Curves and Surfaces with Mathematica" CRC Press.

  Referencia c4: F.Brickell, R.S. Clark: "Differentiable manifolds an introduction", Van Nostrand Reinhold.