VNIVERSITAT DE VALÈNCIA

Course Guide
34165 Classical differential geometrics

COURSE DATA

Data Subject	
Code	34165
Name	Classical differential geometrics
Cycle	Grade
ECTS Credits	12.0
Academic year	2019 - 2020

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
MONTERDE GARCIA-POZUELO, JUAN LUIS	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.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

Contenidos
Se mantienen los contenidos inicialmente recogidos en la guía docente.
Volumen de trabajo
Se mantiene el peso de las diferentes actividades que suman las horas de dedicación en créditos ECTS marcadas en la guía docente original.
Metodología docente
Las clases de teoría se impartirán con documentos de texto y gráfca que se subirán en el Aula Virtual. En estos documentos están las explicaciones detalladas que normalmente se dan en clase en la pizarra o con la ayuda de un proyector de la pantalla del ordenador. Otra herramienta que se podría utilizar es la videoconferencia asíncrona BBC.
Los enunciados de las prácticas se subirán en el Aula Virtual. Algunos días después, una vez que los estudiantes hayan tenido tiempo de resolverlos en casa, se subirán al Aula Virtual las soluciones.

Respecto a los seminarios, se subirán los enunciados en el Aula Virtual, como ya se venía haciendo. El estudiante que desee resolver alguno de los ejercicios, lo que haría normalmente en la pizarra, le enviará la solución al profesor por correo electrónico para su corrección.
Las tutorías se atenderán por correo electrónico. Si es necesario o se estima oportuno se podrá contactar por videoconferencia con el profesor para las explicaciones complementarias necesarias.

Evaluación

Se mantiene el peso relativo de las distintas pruebas con las que se lleva a cabo la evaluación tal como aparece en la guía docente. La prueba fnal será un examen que se distribuirá en el Aula Virtual. Esta prueba no incluirá preguntas teóricas que coinciden con la teoría vista en clase y se basará en cuestiones y problemas. El examen de cada estudiante podrá ser distinto y podrá asignarse de una batería de preguntas distribuidas por temas. El profesor podrá requerir al estudiante que contacto por videoconferencia, si lo considera oportuno, a fin de confrmar la autoría de sus respuestas.

Bibliografía

La bibliografía recomendada se mantiene porque es accesible.