COURSE DATA

Data Subject	
Code	34153
Name	Physics
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1107 - Degree in Mathematics	Faculty of Mathematics	1	Second term

Subject-matter

Degree	Subject-matter	Character
1107 - Degree in Mathematics	3 - Physics	Basic Training

Coordination

Name	Department
FERRANDO BARGUES, JOAN JOSEP	16 - Astronomy and Astrophysics
MORALES LLADOSA, JUAN ANTONIO	16 - Astronomy and Astrophysics

SUMMARY

This is a course devoted to mathematical modeling and, more specifically, to modeling physical theories. This is the appropriate field for this first meeting with the modeling because many fields of mathematics, and in particular much of the contents of the materials of grade, were trying to develop historically rigorous theoretical models of physical theories. The course focuses on into a model of particles within the framework of Newtonian theory, but throughout the development of the course emphasis is being made in physical systems that require a different modeling and a different physical theory to its description.

In this course the student will find applications of different fields of mathematics he has studied in the high school or he is studying in first year of degree (algebraic structures, linear algebra, analysis of one variable). Also he understands the need to explore new fields (theory of curves, ordinary differential equations) that can adequately model physical systems (to describe its laws, to predict their behavior).

Finally, this course will help students understand that the different parts of mathematics are not

watertight compartments but instead, when we make mathematical models in other fields of knowledge, we need to use them together.

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 need knowledge of the subjects Mathematics I and Mathematics II of High School.

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.
- Adapting to new situations.
- 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

• To understand and to handle basic operations with vectors.
• To learn the basic calculus of vector functions with one real variable.
• To understand the mathematical models for space and time of classical mechanics.
• To understand the interest of the theory of curves in the development of the kinematics.
• To understand the principles of Newtonian mechanics and the concepts of linear momentum, angular momentum and center of mass of a particle system.
• To understand that the laws governing the evolution of a system of particles are modeled with differential equations.
• To understand the concepts of kinetic energy, work, conservative forces, potential energy and

mechanical energy, and understand their interest in solving the equations of motion.
• To understand the law of universal gravitation Newton and to know how to solve the problem of Kepler.

DESCRIPTION OF CONTENTS

1. Classical Kinematics

1.- Space and Time in Classical Physics. Vector Calculus.
2.- Curves in space. Vectorial functions.
3.- Description of the movement of a particle: kinematics.

2. Newtonian dynamics

1.- Basic principles. Equations of motion.
2.- Conservation theorems.
3.- Dynamics of a non isolated system of particle.
Annex: Separable differential equations.

3. One-dimensional conservative systems

1.- Kinetic energy and potential energy. Conservation of the total energy.
2.- Phase space. Qualitative study of the equations of motion.
3.- Analytical solution of the equations of motion.
Annex: Improper integrals. Convergence criteria.

4. Conservative forces. Central field

1.- Kinetic energy and work. Theorem of kinetic energy.
2.- Conservative fields. Potential energy and conservation of total energy.
3.- Motion in a central field.
4.- The Kepler problem.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Classroom practices	22,50	100
Other activities	7,50	100
Development of individual work	10,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	22,50	0
Preparation of practical classes and problem	30,00	0
Resolution of case studies	7,50	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The two hour at week theoretical lectures will be devoted to explaining by the teacher, the theoretical subject of the course. For a better understanding of these contents, the teacher will introduce simple examples that may resolve itself or he can ask students to work at home.

The practical weekly class will be devoted to the practical realization of those problems where applying the concepts developed in lectures. In each session the teacher will give a sheet with exercises to develop. After a short introduction by the teacher, which will indicate the general lines of the problem, students work individually or in groups. It will be discussed with the participation of students how each problem has been raised and solved. The exercises that have not been able to work in class time will be solved by the student at home.

In seminar-tutorial classes student will work on exercises by the teacher.

EVALUATION

To evaluate the course will be considered:

1) A written exam that consists of two parts. The first part consists of both theoretical and simple practical questions of application of the theory developed in class. Notes can not be used in this part. In the second part ,notes may be used and consists of problems similar to those made in the practical classes. An score will result from each part. In order to obtain an overall positive evaluation, it is required that the score obtained in each of the the above parts result greater than or equal to 3.5 out of 10. In this case, the score E of the written exam will be the artimetic mean of both scores. In other case, this

mean will be less or equal than 3.5.

2) A continuous evaluation of participation in tutorials and making problems. The 10% of the final mark depends on these tutorials.

3) A control will be proposed over the semester. The 10% of the final mark depends on this control.

REFERENCES

Basic

- b1: Apunts de l'assignatura (Aula virtual)

Additional

- c1: T:M. APOSTOL, Calculus V1. Ed. Reverté.
- c2: I.E. IRODOV, Leyes fundamentales de mecánica. Ed. Mir.
- c3: H.C. OHANIAN, Physics, Ed. W.W. Norton and Company, 1989.
- c4: P.A. TIPLER, G. MOSCA, Física per a la Ciència i la Tecnología, Ed. Reverté, 2010.
- c5: J.R. TAYLOR, Classical Mechanics, University Science Books, 2005.