COURSE DATA

Data Subject	
Code	34262
Name	Atmospheric physics
Cycle	Grade
ECTS Credits	4.5
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
1105 - Degree in Physics	Faculty of Physics	2	Second term

Subject-matter

Degree	Subject-matter	Character
1105 - Degree in Physics	14 - Physics of the earth and the cosmos	Obligatory

Coordination

Name	Department
CASELLES MIRALLES, VICENTE	345 - Earth Physics and Thermodynamics
GILABERT NAVARRO, MARIA DESAMPARADOS	345 - Earth Physics and Thermodynamics

SUMMARY

The academic guide of the course in "Atmospheric Physics" (compulsory course, 4.5 ECTS, fourth semester) aims to explain the student those basic aspects that are considered most relevant to enhance the knowledge acquisition by the students.

The main objective of the course is the study of the physical processes occurring in the atmosphere, defined as a physical system. It is mainly based on the contents of the core subjects, Physics, Mathematics, Mechanics and Thermodynamics, already introduced during the previous three semesters. The contents of this course are also necessary for later courses such as "Renewable energies and solar radiation" and "Remote Sensing".

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Being a second-year course (second semester), the student already has the essential basic knowledge:

1. Fundamental Concepts of Thermodynamics: ideal gas, equation of state and principles of thermodynamics, etc. acquired during the first semester of the second year of the degree.

2. Mechanics: the fundamental concepts for applying Newton's second law in non-inertial reference frames required for Atmospheric Dynamics are also acquired in the first semester of the second year of the degree.

3. The to

OUTCOMES

1105 - Degree in Physics

- Knowledge and understanding of the fundamentals of physics in theoretical and experimental aspects, and the mathematical background needed for its formulation.
- To know how to apply the knowledge acquired to professional activity, to know how to solve problems and develop and defend arguments, relying on this knowledge.
- Problem solving: be able to evaluate clearly the orders of magnitude in situations which are physically different, but show analogies, thus allowing the use of known solutions in new problems .
- Theoretical understanding of physical phenomena: have a good understanding of the most important physical theories (logical and mathematical structure, experimental support, described physical phenomena).
- Be able to understand and master the use of the most commonly used mathematical and numerical methods.
- Modelling & Problem solving skills: be able to identify the essentials of a process / situation and to set up a working model of the same; be able to perform the required approximations so as to reduce a problem to an approachable one. Critical thinking to construct physical models.
- Physics general culture: Be familiar with the most important areas of physics and with those approaches which span many areas in physics, or connections of physics with other sciences.
- Basic & applied Research: acquire an understanding of the nature and ways of physics research and of how physics research is applicable to many fields other than physics, e.g. engineering; be able to design experimental and/or theoretical procedures for: (i) solving current problems in academic or industrial research; (ii) improving the existing results.

- Foreign Language skills: Have improved command of English (or other foreign languages of interest) through: use of the basic literature, written and oral communication (scientific and technical English), participation in courses, study abroad via exchange programmes, and recognition of credits at foreign universities or research centres.
- Learning ability: be able to enter new fields through independent study, in physics and science and technology in general.
- Communication Skills (written and oral): Being able to communicate information, ideas, problems and solutions through argumentation and reasoning which are characteristic of the scientific activity, using basic concepts and tools of physics.
- Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.

LEARNING OUTCOMES

The general procedures and methods that the student should be able to employ after completing the course are:

1. Given a real problem, the student must identify the atmospheric system and find the quantities describing its spatio-temporal variation as well as its constraints.

2. Propose a physical model to diagnose the atmospheric system, validate and assess its sensitivity to the parameters.

3. Make simple hypothesis to predict the system evolution under realistic conditions that alter the values of its parameters.

4. Other transferable skills to other subjects of the Degree are: dealing with different systems of physical units, approximation skills, ability to interpret graphical information and, in general, the critical analysis all kinds of situations.

DESCRIPTION OF CONTENTS

1. Atmospheric Thermodynamics

Origin and composition of the atmosphere. Magnitudes and observables: its measurement. Thermal structure of the atmosphere. The atmosphere as a thermodynamic system. Equation of state and first law of thermodynamics. Phase transitions and second law of thermodynamics. Adiabatic processes in the atmosphere. Atmospheric stability. Convective motion of air masses. Microphysics of clouds.

2. Atmospheric Dynamics

Equation of motion and approximations. General circulation of the atmosphere.

3. Atmosphere and radiation

Fundamental concepts in radiation. Atmospheric absorption. Photochemical processes. Atmospheric dispersion processes. Radiative transfer. Solar and terrestrial radiation. Synoptic radiation balance. Climate change.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Tutorials	7,00	100
Study and independent work	67,50	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

The syllabus will be developed in weekly lectures and exercise-solving sessions, with one of the latter sessions about every two weeks. The student can download from Aula Virtual web server pdf files corresponding to:

1. Academic guide: explains the syllabus and temporal development, objectives, bibliography, methodology and criteria of evaluation.

2. Different exercises to be solved during lecturing sessions and for the student's homework.

3. Slides of the lectures.

Lectures makes use of both video projector and blackboard. In the lectures, the topics are presented in a logical and structured sequence, explaining in detail the key concepts, showing illustrative examples. Student participation is continuously encouraged by asking short questions that clarify the more difficult concepts, by classroom demonstrations, etc.

The exercise-solving sessions are centered around the resolution of some exercises by the lecturer and by the students.

On the other hand, the individual tutoring at the lecturer's office allow the lecturer to continuously help, guide and monitor the progress of the students who participate.

EVALUATION

Assessment systems are:

(1) Written examinations: one part (with a weight between 60 and 70%) will assess the understanding of the conceptual and theoretical formalism of the subject, both through theoretical or conceptual questions and through numerical exercises. Another part (with a weight between 40 and 30%) will assess the problem-solving skills and the ability to critically analyze the results. In both parts, clarity of presentation and corrent logical reasoning will be assessed.

(2) Continuous assessment: assessment of solved exercises presented by students, issues proposed and discussed in class, oral presentations of exercises solutions or any other method involving interaction between lecturers and students.

For those students participating in the activities proposed in (2), the weight of the continuous assessment in the final mark will be equal to 30%.

REFERENCES

Basic

- J.W. Wallace, P.V. Hobbs, Atmospheric Science, Academic Press, Second Edition, 2006.
- M.L. Salby, "Fundamental of Atmospheric Physics". Cambridge University Press, 2012.

ADDENDUM COVID-19

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

In case that health situation requires blended teaching, the teaching model approved by the Academic Degree Committee on July 23, 2020 will be adopted.
For lectures this model consist of 50% student attendance in the classroom, while the rest of students attend the class in streaming broadcast. Two groups will be set with alternate days attendance to the classroom in order to guarantee 50% of teaching hours attendance for all students.
The rest of the teaching activities (laboratories, computer rooms, tutorials) will have a 100% attendance.
If a total reduction in attendance is necessary, classes will be broadcast by synchronous videoconference at their regular schedule, along the period determined by the Health Authority.