Universitat Autònoma de Barcelona

2019/2020

Introduction to Astrophysics

Code: 100161
ECTS Credits: 5

Degree	Type	Year	Semester
2500097 Physics	OT	3	2

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Other comments on languages

The teaching of the subject is done indistinctly in Catalan / Spanish

Teachers

Camilla Maggio

Prerequisites

It is recommended basic knowledge of Newtonian and relativistic mechanics, thermodynamics, statistical physics, electromagnetism and optics, as well as notions of quantum physics and nuclear physics.

Objectives and Contextualisation

On the one hand, to achieve firm knowledge at the introductory level of astronomical objects (mainly stars, galaxies and clusters); on the other, being able to solve problems (not entirely elementary) based on that knowledge.

Competences

- Apply fundamental principles to the qualitative and quantitative study of various specific areas in physics
- Be familiar with the bases of certain advanced topics, including current developments on the parameters of physics that one could subsequently develop more fully
- Develop critical thinking and reasoning and know how to communicate effectively both in the first language(s) and others
- Develop independent learning strategies
- Develop the capacity for analysis and synthesis that allows the acquisition of knowledge and skills in different fields of physics, and apply to these fields the skills inherent within the degree of physics, contributing innovative and competitive proposals.
- Generate innovative and competitive proposals for research and professional activities.
- Respect the diversity and plurality of ideas, people and situations

- Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
- Use mathematics to describe the physical world, selecting appropriate tools, building appropriate models, interpreting and comparing results critically with experimentation and observation

Learning Outcomes

1. Analyse the basic conditions for the development of life on planets.
2. Analyse the general formational aspects for white dwarfs, neutron stars and black holes.
3. Apply the phenomenon of gravitational lensing to determining the mass of astronomical objects.
4. Calculate the mass and temperature of stars.
5. Describe solar atmosphere and the internal structure of the sun.
6. Describe the concepts of opacity and optical depth in stellar atmospheres.
7. Describe the different methods for measuring astronomical distances.
8. Describe the equations of stellar structure.
9. Describe the evolution of stars according to their initial mass in the Hertzsprung-Russell diagram.
10. Describe the origin of chemical elements.
11. Describe the phenomena that lead to the formation of spectral lines.
12. Determine the shape of a galaxy's spiral arms.
13. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
14. Develop independent learning strategies.
15. Generate innovative and competitive proposals for research and professional activities.
16. Introduce the concept of dark matter and the different candidates for this.
17. Relate the apparent and absolute magnitude of astronomical objects.
18. Respect diversity in ideas, people and situations.
19. Use calculus and differential equations in the study of astrophysical phenomena.
20. Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments

Content

1.- Introductory concepts (measurements of distance, brightness, stellar spectra, radiation field),

2.- Stars (birth, star structure, evolution and death, compact objects)

3.- Interstellar medium

4.- Galaxies (types, characteristics, dark matter, evolution, Milky Way)

5.- Clusters of galaxies and large-scale evolution (expansion of the Universe and formation of cosmic structures)

Methodology

Classes of theory and problems.

Various seminars.
Group visit to Parc Astronòmic del Montsec (Àger)

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			

Problems solving at the classroom	14	0.56	1, 3, 19
Theory lectures	27	1.08	2, 1, 3, 4, 6, 11, 9, 5, 10, 8, 13, 12, 15, 16, 18, 19
Type: Autonomous			
Personal studying	63.5	2.54	6, 7, 11, 9, 5, 8, 17
Preparing and writing a report	12	0.48	14, 15

Assessment

Theoretical-practical examinations: with questions and problems about the syllabus taught in class or that the student has worked throughout the course. The examinations will be held on the dates announced for partial examinations in the exam calendar of the faculty. These examinations will have 1 recovery at the end of the course, for students who have not passed them. The global weight is 60%. It is not considered that the students who have passed the course can bid a note by presenting themselves in the repesca exam.

Control tests and Continuous assessment during the course. Global weight of All tests: 20%. Due to its nature, THIS activity does not foresee you repesca.

Completion of 1 individual work. The weight of the work is 20%

In order to pass the course it is mandatory to have Note of All the evaluable activities.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
2 partial exams, none with a weight bigger than 35%	60%	5	0.2	2, 1, 3, 4, 6, 7, 11, 9, 5, 10, 8, 14, 13, 12, 15, 16, 20, 17, 19
Control tests during the course	20%	1	0.04	2, 1, 3, 4, 6, 7, 11, 9, 5, 10, 8, 12, 16, 17, 19
Preparing and writing a report	20%	0	0	14, 13, 15, 20, 18
Repesca: recovery of the two partial examinations	60%	2.5	0.1	2, 1, 3, 4, 6, 7, 11, 9, 5, 10, 8, 14, 13, 12, 15, 16, 20, 17, 19

Bibliography

- Harwit, "Astrophysical Concepts", Springer (3ª edición).

- Prialnik, "An introduction to the Theory of Stellar Structure and Evolution", Cambridge University Press.

- Ostlie& Carroll, "An Introduction to Modern Stellar Astrophysics", Addison Wesley.

- Shu, "The Physical Universe: An Introduction to Astronomy", University Science Books.

- Sparke & Gallagher, "Galaxies in the Universe", Cambridge University Press.

- Tyler, "Galaxies, Structure and Evolution", Cambridge University Press.

- Padmanabhan "Theoretical Astrophysics" (3 volumenes), Cambridge University Press.