

## SUBJECT TEACHING GUIDE

### G69 - Astrophysics

#### Double Degree in Physics and Mathematics

#### Degree in Physics

#### Degree in Physics

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Double Degree in Physics and Mathematics Degree in Physics Degree in Physics			Type and Year	Optional. Year 5 Optional. Year 4
Faculty	Faculty of Sciences				
Discipline	Subject Area: Astrophysics Mention in Fundamental Physics				
Course unit title and code	G69 - Astrophysics				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Web	<a href="https://aulavirtual.unican.es/">https://aulavirtual.unican.es/</a>				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. FISICA MODERNA
Name of lecturer	LUIS JULIAN GOICOECHEA SANTAMARIA
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Office	Facultad de Ciencias. Planta: + 1. DESPACHO PROFESORES (1020)
Other lecturers	DIEGO HERRANZ MUÑOZ GUILLERMO PASCUAL CISNEROS

### 3.1 LEARNING OUTCOMES

- Understand the foundations of the General Relativity, its experimental tests and its impact in the study of the Universe
- Get a global perspective on the different objects and structures in the Universe, as well as of their time evolution
- Know the observations and properties of stars, and understand the stellar models
- Understand the stages of the stellar evolution and the physical models involved
- Know the star systems (binaries and clusters), the circumstellar environment (disks and planets), the interstellar medium and the Milky Way
- Know the properties, the content and the evolution of galaxies
- Understand the active galactic nuclei and the galaxy clustering
- Know and understand the importance of the results about the cosmic microwave background
- Understand the complementarity of observations supporting the Big-Bang theory and the cosmological models

### 4. OBJECTIVES

- Study the properties and composition of stars, galaxies and the Universe as a whole, as well as the physical phenomena occurring at different cosmic scales
- Discuss the physical models that account for the structure and evolution of the Universe and its components
- Gain familiarity with simulations of stars, galaxies and larger scale structures
- Analysis of information in astronomical databases
- Perform work supervised by a professor
- Present small projects, solutions of problems, analysis of data and/or astrophysics topics
- After completing the subject, be able to solve questions and problems with the help of books

### 6. SUBJECT PROGRAM

CONTENTS	
1	Relativity and astrophysics
2	Stars: observations, structure and models
3	Evolution of stars, stellar environment and the Milky Way
4	Normal galaxies and galaxies with active nucleus
5	Cosmology: theory, observations and cosmological parameters
6	Early Universe

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Star Lab: Simulations of stellar structure and evolution	Work	No	Yes	15,00
Galaxy Lab: Analysis of observations of galaxies	Work	No	Yes	15,00
Cosmology Lab	Work	No	Yes	15,00
Exam of questions-problems	Written exam	Yes	Yes	40,00
Relativity Lab	Work	No	Yes	15,00
<b>TOTAL</b>				<b>100,00</b>
<b>Observations</b>				
<p>To pass the course, students must present reports corresponding to all lab sessions and works. If a student does not pass the Convocatoria Ordinaria (January Examination Session), he/she will be able to retake his/her failed exam and failed reports in the Convocatoria Extraordinaria (February Examination Session). Regarding the reports on lab sessions and works in the February Examination Session, these will be presented orally</p>				
<b>Observations for part-time students</b>				
<p>To pass the subject in the ordinary examination session, students enrolled part-time must carry out every lab session/work (in presental or online mode, using the UC Moodle platform). We will also facilitate learning and follow-up of the subject by part-time students, through the availability of notes, problems, etc. in the virtual classroom (UC Moodle platform)</p>				

8. BIBLIOGRAPHY AND TEACHING MATERIALS
<b>BASIC</b>
"Astrophysics in a Nutshell" D. Maoz, 2016 (second edition), Princeton University Press
"Principles of Cosmology and Gravitation" M.V. Berry, 1989, Taylor & Francis