

Academic Year: ( 2022 / 2023 )

Review date: 08-09-2022

Department assigned to the subject: Physics Department

Coordinating teacher: MELENDEZ SANCHEZ, JUAN

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

**REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)**

Standard high-school general knowledge. Basic knowledge of physics and philosophy taught in the first year of this degree.

**SKILLS AND LEARNING OUTCOMES****LEARNING OUTCOMES:**

- Enumerate the principal methods for exploring and learning about the universe and the answers they provide for the questions that humanity asks about the latter.
- Be aware of the importance of the new telescopes in our present-day conception of the universe.
- Recognise the impact of the Ptolemaic and Copernican models on the conception of the role of the human being in the universe.
- Describe the impact of the latest cosmological models on our conception of the world and of our own role in it.
- Recognise the different cosmological models that explain the universe in its entirety and the historical evolution of these models.
- Present your own scientific results to both professionals and the general public.
- Assess the reliability of sources, select important data and cross-check information.
- Develop teamworking skills, blend in and actively collaborate in achieving common goals.

**OBJECTIVES**

Understand the characteristics of mythical cosmologies and their differences with later cosmologies, elaborated within the philosophical and scientific framework.

Distinguish between the different conceptions of the pre-Socratic philosophers about the origin and ultimate reality of the cosmos.

Be able to explain how the cosmological two-sphere model was arrived at, starting with the rational interpretation of astronomical observations.

Explain the subsequent developments of Greek astronomy, up to Ptolemy's synthesis, and its integration into the Aristotelian conception of the world.

Understand the situation of astronomy at the beginning of the Renaissance, and the role played by Copernicus, Brahe and Kepler in the elaboration of the new heliocentric cosmology.

Appreciate the impact of heliocentrism and the new conception of science that the Scientific Revolution on the culture of the time: how it affected the self-concept of humanity.

Being able to describe the achievements of the two greatest figures of the Scientific Revolution, Galileo and Newton, in the field of science, astronomy, and scientific methodology. Being able to solve basic physics problems by applying their discoveries.

Appreciate the impact of the Newtonian worldview, both in the concept of science and in the conception of the universe. Learn about the main scientists who built the worldview of classical physics throughout the 18th and 19th centuries.

Understand the reasons for the crisis in the worldview of classical physics at the beginning of the 20th century.

Distinguish the changes produced by quantum theory and by relativity.

Be able to describe the main results of astronomical observation and their relationship with cosmological models.

Appreciate the role of technology (in particular, the evolution of telescopes) in achieving these advances.

Qualitatively understand contemporary ideas about the origin, structure and evolution of the universe.

Appreciate the effect of these cosmological ideas on humanity's view of itself.

## DESCRIPTION OF CONTENTS: PROGRAMME

1. From myth to logos: Thales of Miletus and his time
2. The birth of physical theory: the universe of the two spheres
3. Aristotle's cosmos
4. From antiquity to the modern era: astronomy vs cosmology.
5. The Copernican Revolution
6. Galileo: the birth of modern science
7. Newtonian cosmology.
8. The universe of classical physics: rise and fall
9. Relativistic cosmology.
10. Origin, structure and evolution of the universe: contemporary ideas.

## LEARNING ACTIVITIES AND METHODOLOGY

### TRAINING ACTIVITY

Directed activity: 200 hours - 100 face-to-face  
supervised activity: 100 hours - 17 face-to-face  
Autonomous activity: 300 hours - 0 attendance

### TEACHING METHODOLOGIES

- Master Classes
- Cooperative learning
- Text commentary
- Classroom practices
- Problem classes
- Seminars

## ASSESSMENT SYSTEM

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|---|----|
| <b>% end-of-term-examination:</b>   | 50 |
| <b>% of continuous assessment (assignments, laboratory, practicals...):</b> | 50 |
- Percentage weight of the Final Exam= 50
  - Percentage weight of the rest of the evaluation (continuous evaluation)= 50  
The continuous evaluation will have two components (each one will be worth 50%)  
Submission of problems and/or short essays; presentations in class.  
Short-term tests, done during class time

## BASIC BIBLIOGRAPHY

- CROWE, M. J. Theories of the world - From antiquity to the copernican revolution, Dover, 2001
- DRAKE, S. Galileo. A Very Short Introduction, Oxford University Press, 2001
- ELIZALDE, E. The True Story of Modern Cosmology: Origins, Main Actors and Breakthroughs, Springer, 2021
- FREELY, J. Flame of Miletus: The Birth of Science in Ancient Greece (and How it Changed the World), I. B. Tauris, 2018
- GARCÍA HOURCADE, J.L Copérnico y Kepler. La rebelión de los astrónomos, Nivola, 2000
- KOESTLER, A. The sleepwalkers. , Arkana Penguin Book, 1989
- KUHN, THOMAS S The Copernican Revolution: Planetary Astronomy in the Development of Western Thought, Harvard University Press, 1992

- MELÉNDEZ, J. De Tales a Newton: ciencia para personas inteligentes, Ellago, 2013
- ORDOÑEZ, J., NAVARRO, V., SANCHEZ RON Historia de la Ciencia, Espasa, 2013
- RIOJA, A., ORDÓÑEZ, J. Teorías del Universo. Vol. I: De los pitagóricos a Galileo, Síntesis, 1999
- RIOJA, A., ORDÓÑEZ, J. Teorías del Universo. Vol. II: De Galileo a Newton, Síntesis, 1999
- RIOJA, A., ORDÓÑEZ, J. Teorías del Universo. Vol. III: De Newton a Hubble, Síntesis, 2006
- ROSSI, P. The Birth of Modern Science, Wiley-Blackwell, 2001
- SAMBURSKY, S. The Physical world of the greeks, Princeton University Press, 2016

#### ADDITIONAL BIBLIOGRAPHY

- ARANA, J. Materia, universo, vida. , Tecnos, 2001
- BUTTERFIELD, H. The Origins of Modern Science, Hassell Street Press, 2021
- COHEN, BERNARD L. The Birth of a New Physics, W. W. Norton & Company, 1985
- GEROCH, R General Relativity from A to B, University of Chicago Press, 1981
- SOBEL, DAVA Longitude: The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time, Bloomsbury, 2007
- WESTFALL, R.S The Construction of Modern Science: Mechanisms and Mechanics, Cambridge University Press, 1978
- WOOTTON, D. The Invention of Science: A New History of the Scientific Revolution, Harper Perennial, 2016