60025 - Research methodology in physics

Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	538 - Master's in Physics and Physical Technologies
ECTS	6.0
Year	1
Semester	First semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Introduction

The goal of the course is to introduce students to the research methodology in science. To do so, both theoretical and applied aspects will be combined in the four parts the course is divided in:
1. The process of scientific research.
2. Ethical aspects of the research work.
3. Introduction to scientific policies.
4. Communication techniques.

1.2.Recommendations to take this course

1.3.Context and importance of this course in the degree

This is a cross-curricular subject, which may be of interest for those students who are considering undertake a research career, especially in the fields of physics and technologies in physics.

1.4.Activities and key dates

2.Learning goals

2.1.Learning goals

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

The course is planned in such a way that once completed:
- The students will have acquired the necessary knowledge about how research teams work, the methodology they use, the ethical aspects and the social and political contexts; all this will ease their own research activity.
- The students will be able to present and defend their project with accuracy, both in oral and written speeches, and at educational and specialized levels.

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3.2.Competences

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

There will be a continued assessment of each of the main parts in which the course is divided, with a weighting of the grades as indicated:

Part 1: The process of scientific research (20%)

The students will write a summary and answer to some questions related with the epistemology of science and the scientific method in physics. It will be assessed: the ability to synthesize, the accuracy in the answers, and the presentation and discussion in class.

Part 2: Ethical aspects of the research work (15%)

The students will analyze a scientific fraud (either of historical or contemporary character) and discuss its key points, extracting the main conclusions of this exercise. It will be assessed: the affinity of the subject to the scope of knowledge of the Master, the ability to analyze the case, the conclusions obtained and the oral presentation made by the student.

Part 3: Introduction to scientific policies (15%)

The students will have to find calls for proposals which may be of their interest. They will have to collect the necessary documentation and give a description of their characteristics (scientific area, conditions of the call, covered expenses). It will be assessed: the relevance and suitability of the calls to the proposed situations.

Part 4: Communication techniques (50%)

The students will have to produce a research paper about a topic of their choice (not necessarily an original work) in the format appropriate for a journal that will be selected according to its quality criteria and its scope. It will be assessed:

- The design and preparation of the paper according to the requirements of the publication.
- The clarity in the exposition of ideas and the correctness in the use of the English language.
- The abstract and the conclusions.
- The use of adequate bibliographic references.
- The use of relevant figures and/or tables.

This work will have to be defended in public with the help of a PowerPoint-type presentation. It will be assessed:

- The order and clarity of the presentation.
- The synthesis of ideas.
- The usage of oral and visual elements to attract the attention of the audience.
- The capacity to hold a debate about the ideas given in the presentation.

Both activities will be carried out in English.

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The grade of "Matrícula de Honor" will be awarded according to the current regulation, that is, among the students with the highest grade of "Sobresaliente". In case of doubt, it will be proposed a specific work of optional nature.

The course has been designed in such a way that the continued evaluation is possible even in those cases in which students cannot regularly attend the lectures. Students who have not passed the subject with the proposed activities (or those who want to raise the work grade) will be able to make a global test within the period scheduled for examinations. This test will consist of an exercise of theoretical or practical nature, and/or the presentation of assignments, to be determined by the teacher according to the shortcomings showed by the student.

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, practice sessions using the computer, tutorials, small group work, and student active participation, study, and autonomous work.

However, there will be no specific practice sessions apart from the activities carried out in the ordinary schedule of the course.

5.2.Learning tasks

The course includes the following learning tasks:

- **Learning task 1:** Knowledge acquisition of the main contents of the course (3 ECTS). The methodology followed consists on lectures; case-based learning; tutorials. Attendance**:** 40%
- **Learning task 2:** Case analysis, sharing and discussion about the contents of the course (1.5 ECTS). The methodology followed consists on case-based learning; work in small groups; classroom presentation and discussion.Attendance: 40%
- **Learning task 3:** Writing and oral defense of scientific works (1.5 ECTS). The methodology followed consists on tutorials; written preparation of a research paper; public presentation of the paper. Attendance: 40%

5.3.Syllabus

The course will address the following topics:

Topic 1. The process of scientific research.

- The scientific method, research planning; the scientific explanation and demarcation criteria, characteristics of factual sciences, scientific epistemology, technology as transformational knowledge, relations between science and technology, the researcher and the structure of the research teams.

Topic 2. Ethical aspects of the research work.

- Scientific ethics, axiology and ethical values of science, ethics of the researcher, personal code of conduct, internal code of conduct, conduct guidelines, ethical standards of publication, scientific fraud and malpractice; study of historical and contemporary cases.

Topic 3. Introduction to scientific policies.

- Typology of research projects, strategic plans and guidelines, research products: open access publications, patents, utility models, trade secret, etc.; training of researchers, preparation of research projects, monitoring and evaluation

processes.

Topic 4. Communication techniques.

- Dissemination of results, technical and scientific documents, characteristics and quality indices of journals, English usage in academic contexts, structure of scientific documents, preparation of written documents (research articles, reports), computer tools, techniques of oral presentation and defense of research works, other formats (posters, flash presentations, etc.), skills for academic writing and speaking in English, online communication technologies, evaluation procedures.

5.4.Course planning and calendar

Further information concerning the timetable, classroom, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Faculty of Science website http://ciencias.unizar.es/

5.5.Bibliography and recommended resources