2017/2018

Teaching Methods for Physics and Chemistry
Code: 42087
ECTS Credits: 27

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**Use of languages**

Principal working language: catalan (cat)

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**Degree**

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<th>Degree</th>
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<td>4310486 Teaching in Secondary Schools, Vocational Training and Language Centres</td>
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**Contact**

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**Teachers**

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Digna Maria Couso Lagaron
Anna Marbà Tallada
Begoña Oliveras Prat
Sandra Saura Mas
Victor Lopez Simo

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**External teachers**

Jordi Domènech

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**Prerequisites**

No requierements

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**Objectives and Contextualisation**

The aim of the course is to complete the knowledge of future science teachers of biology, geology, physics and chemistry graduates, engineers or graduates and bring them to the knowledge of science education and the specific teaching of each discipline.

It consists of two modules differentiated content:
- The additional training module that aims to complete the knowledge of biology, geology, physics and chemistry graduates, engineering graduates or future science teachers. It includes blocks of history of science and current events and training complements.

- The module specific teaching and teaching innovation and introduction to research aimed at training the future high school teacher that can teach the contents of the knowledge areas of biology and geology and physics and chemistry, integrating disciplinary knowledge and the teaching of science taking into account the knowledge of other areas such as epistemology, language and communication, psychology and pedagogy. Includes blocks introduction to didactics, the didactics of biology and geology and teaching innovation and introduction to research.

Content

The specific module of Physics and chemistry and its teaching is divided into 2 large blocks: Physics and Chemistry didactics and Complementary Training.

**PHYSICS AND CHEMISTRY DIDACTICS**

The block "Physics and chemistry didactics" is divided into 2 parts: "Learning and teaching Physics and Chemistry" (9cr) and "Teaching innovation and introduction to research in Physics and Chemistry didactics" (6cr).

**Learning and teaching Physics and Chemistry (9cr)**

**Introduction to Science Education (3cr)**

- Purpose of teaching science at ESO
- The teaching of science and development of scientific competence
- What is science? Reflections on the epistemology of science
- What science should be taught in school?
- Didactic models and preconceptions
- The learning cycle and activities
- Assessment and regulation of learning

**Chemistry Didactics (3cr)**

- Purposes of teaching chemistry.
- The great ideas of chemistry (substances "chemical species" chemical change, molecular-kinetic model). Identifying key curriculum models (model kinetic model atomomic and atomic model classic). Selection and sequencing of content to teach.
- Scenarios and learning resources
- The teaching of chemistry in teaching and learning chemical change
- The water and ions dissolutions
- Electricity and chemical change
- Modeling, investigation and argumentation in school chemistry
- Laboratory work in Chemistry
Physics Didactics (3 cr)

- The school physics models and key concepts: and because
- Ideas and ways of reasoning of the students in physics
- Modeling, school physics inquiry and argumentation
- Acts paradigmatic you real problems and controversy as socio-scientific contexts relevant to the teaching of physics.
- Using ICT Work and experimental physics

Teaching innovation and introduction to research in Physics and Chemistry didactics (6 cr)

Teaching innovation

- The curriculum. Learning objectives, programming and evaluation.
- Diversity of types of competence teaching units according to the approach: progressions, projects, inquiry, ABP, modelling etc.
- Contexts and knowledge transfer.
- The development of transversal skills: critical thinking, cognitive-linguistic, digital, self-regulation, etc.

Introduction to Physics and Chemistry Education Research

- Reflective practice: reflection on practice and its relationship to educational innovation
- The classroom observation: goals, models of observation and instruments
- Methodological bases for innovation and educational research
- Current trends in research in science education

COMPLEMENTARY TRAINING

The block "Complementary Training in Biology and Geology and Physics and Chemistry" is divided into 2 parts: History of Science and Fundamentals of biology, geology, physics and chemistry.

History of Science (4 cr)

Through critical analysis of authors and relevant episodes, this part is intended that the student acquire a basic historical master scientific culture.

1. Thinking mythical, natural thought. Reading: Aristotle and Galen
2. The Journey of the Almagest. Views: Copernicus
3. The mathematization of nature. Views: Galileo
4. The world system. Views: Newton
5. The two cultures. Readings: Frankenstein
6. The historical view of life. Readings: Darwin
8. The new atoms. Views: Curie
10. Chaos, order and dinosaurs. Views: Crichton

In the first part of each session we will discuss and discuss the proposed texts for the topic that we will have exposed in the previous session. In the second part we will present a new theme and propose issues so you can read the text or texts proposed for the next session.

Fundamentals of Biology, Geology, Physics and Chemistry (6 cr)
Work on fundamental contents of biology, geology, physics or chemistry to supplement the initial training of future teachers of physics and chemistry. Students will attend two disciplinary basis depending on their initial training. Students may attend different disciplinary courses depending on their previous formation. The contents to study are:

**Fundamentals of Biology (3cr)**


- Human body: General organization of the human body. Anatomy and physiology of the human body devices. endocrine sensory organs, nervous system and


- Organisms and systems. Levels of ecological organization. Basic principles of ecology.

**Fundamentals of Geology**

- Geology as a science. The Earth as a complex system.

- Earth materials: rocks, rock cycle.

- Geology of Catalonia. Geological history and landforms. Field work in the area of the Sant Jaume stream between the towns of Olesa de Montserrat and Vacarisses.

- History of the Earth: strata, sedimentary structures, sedimentary environments, stratigraphic record, continuity and discontinuity, geological time, dating and fossils

- History of the Earth: geological maps, map elements, maps and geological sections, geological history.

- Earth materials: minerals, rock builders and resource base.

Interdisciplinary project linked to Fundamentals of Physics:

- Sun-Earth system.

- Internal structure and Earth changes: global tectonics, earthquakes, volcanoes, tectonic deformation and structures, landscape as an interaction between internal and external processes. Geological hazards.

**Fundamentals of Physics**

- Measurement and analysis

- How to determine the correlation between variables.

- The Multilog-Pro team and Multilab program.

- Examples of relations between position, velocity and acceleration.
- Forces and Motion
- The concept of force and their types.
- Examples of movements with and without friction. Useful use of frictional forces.
- The dynamic equilibrium: motion at constant speed.
- Energy view of the processes
- Energy conservation.

Electromagnetism
- The electric field and magnetic. Experimental determination of the field lines.
- An experiment on electromagnetic induction.
- Wave phenomena.

**Fundamentals of Chemistry**
- Pure substances and dissolutions. Chemical change.


- Stoichiometry


- Heat of chemical reactions

Laboratory. Exothermic reaction. Endothermic reaction.


- Chemical kinetics.

Laboratory. Chemical reaction speed observation. Reaction speed dependence regarding temperature and reagents.

Discussion and exercises. Fast and slow reactions. Chemical reaction speed concept. Order of reaction and constant of reaction.

- Chemical balance and acid-base reactions

Laboratory. Observations of chemical balance in different reactions.


Laboratory. pH measure of real samples and solutions.
Discussion and exercises. Acid-base reaction concept: H+ transfer. Ionization of water (Kw) and acid or base strength (Ka and Kb). pH scale. Acid-base Indicators.

- Redox reactions and batteries

Laboratory. Redox reactions observation.


Laboratory. Battery construction and electromotive force (FEM)


**Interdisciplinary Project of Biology and Chemistry**

This is a transversal activity of ”Fundamentals of Biology” and ”Fundamentals of Chemistry”, it is scheduled to be done in groups.

**Interdisciplinary Project of Physics and Geology**

This is a transversal activity of ”Fundamentals of Physics” and ”Fundamentals of Geology”, it is scheduled to be done in groups.

**Topics of current science (2cr)**

Issues in the field of science with a high degree of social impact that will help the future teacher to promote discussion with high school students to arrive at a reasoned opinion on them.

The topics will be among the following:

- Science, money and politics

- Gender and Science

- Neuroscience and education: towards a new paradigm of learning processes.

- Ethnificate representations of alumni: from cultural essentialism to deficit perspectives.