Universitat Autònoma de Barcelona

Teaching Methods for Physics and Chemistry

2016/2017

Code: 42087
ECTS Credits: 27

Degree	Type	Year	Semester
4310486 Teaching in Secondary Schools, Vocational Training and Language Centres	OT	0	A

Contact

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Use of languages

Principal working language: catalan (cat)

Teachers

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External teachers

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Prerequisites

No requierements

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 atomicomolecular 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(3cr)

- 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 andexperimental 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 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, phisics and chemistry

History of Science (4cr)

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

- Thinking mythical, natural thought. Reading: Aristotle and Galen

- The Journey of the Almagest. Views: Copernicus

- The mathematization of nature. Views: Galileo

- The world system. Views: Newton

- The two cultures. Readings: Frankenstein

- The historical view of life. Readings: Darwin

- Newtonian crisis. Readings: Einstein

- The new atoms. Views: Curie

- Individual, information and society. Views: Watson

- 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.

Every three sessions, will be asked to individually deliver a text of 600 words (2 pages) on one of the sessions. From the proposed readings, it is that each student builds a complementary or critical text with the exposure of the subject in class. We propose issues that can guide them in the preparation of this text.

Fundamentals of Biology, Geology, Physics and Chemistry (6cr)

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.

The distribution is as follows:

- Chemicals and related courses will attend Biology and Physics
- Physical and related course will attend Chemistry and Geology

The contents to study are:

Fundamentals of Biology (3cr)

- The Chemistry of Life: Chemical components of the cell. Bioelements. Organic molecules. Biocatalysts. Introduction to metabolism

- The Genetically modified organisms (GMOs): transgenic plants. Handling plant genome for transgene introduction. Examples.

- The cell: The prokaryotic cell and eukaryotic. structure and function of the organelle. Organizational models. Cellular division. Virus and bacteria.

- Basis of Inheritance: Classical Genetics. Mendel's laws. sex-linked inheritance. Identification of DNA as the carrier of genetic inheritance Humana (Human Genome). Alterations of the genome.

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

- Origin of life. Biological Diversity. Fixity and evolutionism. Darwinian selection. Fossil hominids to the Homo Sapiens and Evolution of Man.

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

Fundamentals of Geology

- Geology as a science.

- The system Sun and Earth

- The Earth as a complex system.

- Earth materials: minerals, rocks and forming resource.

- Earth materials: rocks, rock cycle.

- The internal structure and land changes: global tectonics, earthquakes, volcanoes and tectonic deformation structures, landscape as interaction between internal processes and external processes. Geological risks.

- Earth History: 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.

- 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.

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.

- Mechanisms of energy transfer and its relationship withthe power quality. Probabilistic interpretation of the Second Law of Thermodynamics.

- Electromagnetism

- The electric field and magnetic. Experimental determination of the field lines.

- An experiment on electromagnetic induction.

- Wave phenomena.

Fundamentals of Chemistry

- Chemistry in high school. Chemistry in the ESO and Baccalaureate. Chemistry and society.

- The chemical change. simple substance, composed and substance mixtures. physical change and chemical change. The periodic table. Formulation.

- Chemical reactions. atomic mass and relative molecular mass. Avogadro's number. Amount of substance: mole. Stoichiometry.

- Heat of chemical reactions. Thermochemical. Internal energy and enthalpy: heat. exothermic and endothermic reactions. Standard enthalpy of formation and standard enthalpy of a reaction. Hess law.

- Speed chemical reactions. Chemical kinetics.

- Chemical balance. reversible reactions. Spontaneity. Equilibrium constant. Change in balance.

- Acid-base reactions. Acid-base balance. Acids and bases: strong and weak. pH. buffer solutions. Acid-base titrations.

- Precipitation reactions. Solubility and precipitation. Solubility equilibrium.

- Redox reactions. Oxidation and reduction. Batteries. Electrolysis.

- Chemical laboratory. Making content related to previous practices

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

- Climate change

- Genetically modified organisms

- Gender and Science