Study Plan

School: School of Sciences and Technology
Degree: Master
Course: Chemistry in School (cód. 587)

1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
PED10096M	Didactics of Physics and Chemistry I	Education Sciences	6	Semester	156
QUI10097M	Current Themes in Chemistry I	Chemistry	6	Semester	156
FIS10098M	History and Philosophy of Sciences	Physics	6	Semester	156
PED10099M	Information Technologies in Teaching	Education Sciences	6	Semester	156
QUI10100M	Chemistry of Materials	Chemistry	3	Semester	78
QUI10101M	Industry and Environment	Chemistry	3	Semester	78

1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
PED10102M	Didactics of Physics and Chemistry II	Chemistry	6	Semester	156
QUI10103M	Current Themes in Chemistry II	Chemistry	6	Semester	156
QUI10104M	Experimentation in Chemistry	Chemistry	6	Semester	156
PED10105M	Educational Research Methodologies	Education Sciences	3	Semester	78
QUI10106M	Chemistry and Society	Chemistry	3	Semester	78
QUI10107M	Laboratorial management and safety	Chemistry	6	Semester	156

2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Dissertation					

2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Dissertation					

Conditions for obtaining the Degree:

*** TRANSLATE ME: Para aprovação na componente curricular deste Mestrado, é necessário a aprovação (através de avaliação ou creditação) das seguintes unidades curriculares: {\}newline

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1.º Semestre{\}newline

- 6 UC Obrigatórias num total de 30 ECTS{\}newline

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2.º Semestre{\}newline

- 6 UC Obrigatórias num total de 30 ECTS{\}newline

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Para obtenção de grau, é necessário também a aprovação em Dissertação no total de 60 ECTS no 3.º e 4.º Semestre. ***

Program Contents

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Didactics of Physics and Chemistry I (PED10096M)

- Current trends for the science curriculum and science education: pedagogical and epistemological foundations; scientific literacy as a paramount educative concept.
- The Portuguese physics and chemistry curricula for the 3rd cycle of basic education and for secondary education.
- Individual factors of learning science: cognitive development and logical thinking; cognitive styles and multiple intelligences; the challenges posed by the modern science concepts.
- Spontaneous and scientific concepts: psychogenesis and sociogenesis.
- Language, communication and learning in physics and chemistry: the semantics and the syntax of the scientific discourse; mathematical language and the graphical and multimedia representations.
- Problem solving in science education: cognitive, metacognitive and socioafective foundations; knowledge representation and knowledge organization as decisive dimensions.

Practical work in school physics and chemistry: the contribution of the ICT.

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Current Themes in Chemistry I (QUI10097M)

The program is not fixed but varies from year to year depending on the people invited, the specific subjects requested by the students and the specific subjects which the lecturer decides to present from his own portfolio. Just for example, some of the subjects treated in previous years were: Green Chemistry, Computational Chemistry, Chemical Synthesis and the 2010 Nobel, New Carbon Materials, Forensic Chemistry, Biofuels, Chiral Compounds.

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History and Philosophy of Sciences (FIS10098M)

Historical perspective of socio-economic interaction and cultural development of scientific knowledge. The philosophical background of the philosophy of science: the problem of demarcation between science and non science. Historical perspective of the construction of scientific theories: the role of controversy. The Life Sciences in nineteenth century and in the transition for the twentieth century. Philosophy of Science at the turn of the century XX: Mach, Duhem and Poincare. The Philosophy of Science in the Twentieth Century: neopositivism, Bachelard, Popper, Kuhn, Lakatos, Holton. The scientific controversy. Scientific disputes: historical and disciplinary diffrences. Scientific controversies, special cases. The scientific controversy and science teaching.

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Information Technologies in Teaching (PED10099M)

Introduction (use of computers in science - historical perspective, architecture of a modern computer).
Information and Communication Technologies versus Education in Chemistry - state of the art.
Production of educational materials using the "Microsoft Office".
Information and Communication Technologies versus Web.
Digital Educational Resources.
Distance learning - e-learning.

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Chemistry of Materials (QUI10100M)

Taking into account the reduced number of ECTS, it is not possible to go into great depth nor to present everything that would be desirable. Hence a selection, where the students have weaknesses or feel particularly interested, needs to be made. Some of the topics that have been presented in previous versions of the MQCE include:
Polymers: Molecular Structure, Polymerisation Mechanisms, Properties, Processing, Applications.
Liquid Crystals: Types, Properties, Applications.
Ceramics: Sol-Gel Syntheses, Inorganic Gels.
Composites: Types, Properties, Applications
Carbon Materials: Activated Carbon, Carbon Black, Diamond, Nanotubes, Fullerenes and Graphene.
Porous Materials: Zeolites, Mesostructured Materials, MOFs, Aerogels
Biomaterials.
Applications of Materials in Health, Energy, Transports and Construction.
Characterisation Techniques.
Besides the theoretical classes the students are also given the opportunity to carry out some experiments in the laboratory.

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Industry and Environment (QUI10101M)

Seveso accident. Dioxins and dibenzofurans in the environment. Dioxin hazards. The Seveso Directive. Minemata Accident. Mercury and methylmercury in the environment. The hazards metals in the environment. Bhopal accident. Flixborough, Toulouse, Basel and Rhine accidents. Typical industrial risks. Accidents and law. REACH regulation.

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Didactics of Physics and Chemistry II (PED10102M)

For a situated learning and development of the physics and chemistry teacher:
1.1. from the physics and chemistry tacit knowledge to his explicit knowledge: pedagogical dissonances and coping strategies.
1.2. physics and chemistry teachers' training needs: a representative sample.
2. Interdisciplinarity and transdisciplinarity in the teaching of physics and chemistry: Problem-Based Learning as an important example.
3. The relations between Science-Technology, Society and the Environment: a pedagogical approach in the teaching of physics and chemistry; contributions of physics and chemistry to a strategy for a sustainable development.
4. Planning teaching units of physics and chemistry: some structural axes: sustainable development, problem solving, scientific literacy and citizenship education.

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Current Themes in Chemistry II (QUI10103M)

The program is not fixed but varies from year to year depending on the people invited, the specific subjects requested by the students and the specific subjects which the lecturer decides to present from his own portfolio. Just for example, some of the subjects treated in previous years were: Applications of Data Mining in Chemistry, Quality Control, Sol-Gel Processes and Aerogels, Emerging Applications of Electrochemistry, Liquid Crystals, Ordered Mesoporous Materials and Control of Structure at the Nanoscale, Chemistry in National Companies.

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Experimentation in Chemistry (QUI10104M)

Experimentation in the teaching of chemistry: Background. Historical perspective.
Objectives of the experimental work in the teaching of chemistry.
Practical work, laboratory work and experimental work.
Conceptualizations, goals and limitations.
Models of investigative activities.
Degree of opening an investigation.
Planning of laboratory sessions.
Pre-Lab sessions.
Preparation of experimental activities to be developed.
Definition of objectives to be achieved by carrying out the proposed activities.
Design and development of educational projects of an experimental nature.

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Educational Research Methodologies (PED10105M)

1. Research as an essential dimension of professionalism
1.1. Relationship between scientific knowledge and professional practice
1.2. The research as a mean to support the educational action
2. Epistemology and research methodology
2.1. Construction of scientific knowledge
2.2. Fundamentals of scientific knowledge
2.3. Research paradigms: scientific / positivist and naturalist / interpretive
3. Steps in research
3.1. Identifying the problem
3.2. Review of literature
3.3. Population and sample
3.4. Research designs: experimental, case study, action research
3.5. Construction of instruments for data collection: observation, interviews, questionnaires.
3.6. Data Collection
3.7. Data Analysis
4. The writing of scientific reports.
5. The Ethics of Research

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Chemistry and Society (QUI10106M)

The scientific method. Science and the epistemological and ethical challenges. Science vs. Technology.
Chemistry and environment (lithosphere, the stratosphere, the hydrosphere and atmosphere, air pollution, acid rain, particulate aerosols, greenhouse effect, toxic effects of air pollution, pollution of soils and aquifers, fertilizer and pesticides, pollution, anthropogenic vs. natural pollution) .
Chemical and food (vitamins, minerals, hormones, food additives, preservatives, antioxidants, chemical processes in the kitchen).
Chemical and energy (oil and fossil fuels, power plants, solar energy, nuclear reactors, new sources of energy, pros and cons).
Chemistry, biochemistry and medicine.
Chemistry and heritage (the materials used in artistic production, degradation and diseases, production techniques, technical analysis and diagnosis of assets).
Chemical and synthetic materials.
Chemical and consumer goods
Chemistry and war

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Laboratorial management and safety (QUI10107M)

Safety rules. Safety equipment and hygiene laboratory. Prevention of laboratory accidents. Emergency and evacuation plans. Laboratory waste
disposal. Development of databases and laboratory management. The laboratory design considering functionality, security and economy.
Acquisition of goods and services