COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHY101 (1.1)**	**SEMESTER**	**1st**
COURSE TITLE	**Analytical Chemistry I**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on analytical chemistry (Methods of Chemical Analysis. Chemical Reactions (writing and completing). Solutions and concentrations. Stoichiometric computations. Chemical equilibrium and rate of a chemical reaction. Equilibria of weak acids and bases. Water ionisation-hydrolysis-pH. Heterogeneous equilibria. Precipitation-Equilibria involving complex ions. Zwitterionic compounds and redox systems. Applications in Analytical Chemistry). They will learn how to search in literature and analyze data using new technologies. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Working independently
Team work
Respect of natural environment
Promoting free, creative and inductive thinking
Understanding analytical science, demonstrate a coherent understanding of analytical chemistry
Depth and breadth of analytical chemistry knowledge
Inquiry and problem solving, critically analyse and solve problems in analytical chemistry
Personal and professional responsibility, be accountable for individual learning and scientific work in analytical chemistry

(3) SYLLABUS

Methods of Chemical Analysis. Chemical Reactions (writing and completing). Solutions and concentrations. Stoichiometric computations. Chemical equilibrium and rate of a chemical reaction. Equilibria of weak acids and bases. Water ionisation-hydrolysis-pH. Heterogeneous equilibria. Precipitation-Equilibria involving complex ions. Zwitterionic compounds and redox systems. Applications in Analytical Chemistry

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>75</td></tr>
<tr><td>Not guided study</td><td>50</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Written examination in Greek, with multiple choice questionnaires and short-answer questions.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- *ΒΑΣΙΚΕΣ ΑΡΧΕΣ ΑΝΑΛΥΤΙΚΗΣ ΧΗΜΕΙΑΣ* *ΘΕΜΕΛΗΣ ΔΗΜΗΤΡΙΟΣ* *ΖΗΤΗ ΠΕΛΑΓΙΑ ΚΑΙ ΣΙΑ Ο.Ε.*

ΣΗΜΕΙΩΣΕΙΣ ΜΑΘ. ΑΝΑΛΥΤΙΚΗΣ ΧΗΜΕΙΑΣ Ι	*Α. ΒΛΕΣΣΙΔΗΣ* *Δ. ΓΚΙΩΚΑΣ*	*ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)*
• *ΧΗΜΙΚΗ ΙΣΟΡΡΟΠΙΑ ΚΑΙ ΑΝΟΡΓΑΝΗ ΠΟΙΟΤΙΚΗ ΗΜΙΜΙΚΡΟΑΝΑΛΥΣΗ*	*ΘΕΜΙΣΤΟΚΛΗΣ ΧΑΤΖΗΪΩΑΝΝΟΥ*	*ΕΛΕΝΗ ΧΑΤΖΗΪΩΑΝΝΟΥ*
• *ΣΗΜΕΙΩΣΕΙΣ ΜΑΘ. ΑΝΑΛΥΤΙΚΗΣ ΧΗΜΕΙΑΣ Ι*	*Α. ΒΛΕΣΣΙΔΗΣ* *Δ. ΓΚΙΩΚΑΣ*	*ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)*

- *D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Fundamentals of Analytical Chemistry, 9th ed, Brooks/Cole Publ., Belmont (CA), 2014, pp. 2-437.*
- *Αναλυτική Χημεία e-book, Σ. Λιοδάκης (http://www.lib.ntua.gr/gr/el_sources/ebooks/liodakis/index.htm)*
- *ΠΟΣΟΤΙΚΗ ΧΗΜΙΚΗ ΑΝΑΛΥΣΗ, Τόμος Α, Χανιωτάκης Νίκος, Φουσκάκη Μαρία, Πανεπιστημιακές Εκδόσεις Κρήτης, 2009*

- Related academic journals:

Journal of Chemical Education
Analytical Chemistry
Analytica Chimica Acta
Talanta

INORGANIC CHEMISTRY I COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	XHY011	**SEMESTER**	**1st**
COURSE TITLE	INORGANIC CHEMISTRY I		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
FOR THE WHOLE COURSE	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background, specialised general knowledge
PREREQUISITE COURSES:	NONE
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=756

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The aim of the course is to teach and embody basic principles of Inorganic Chemistry that are considered necessary for both the theoretical and laboratory education of undergraduate students in this area

• Upon successful completion of the course, students should be able to:
1. Recognize the contribution of inorganic chemistry to the development of chemistry and other related disciplines

2. Be able to calculate (given the appropriate data) basic thermodynamic quantities, the chemical reactions equilibrium and rate constants

3. Write down the electron configuration of any element or ion based on the building principles
4. Be able to predict the trends of basic properties (ionization energy,

electronegativity, atomic radii, etc) of the elements

5. Identify the different types of chemical bonds and how these are formed

6. Easily use the atomic/molecular orbital theory, the valance bond theory and the VSEPR model when prediction of the geometry, bond order, hybridization, etc. of simple compounds are required

7. Know some basic properties (geometry, metal coordination modes, uses, etc.) of selected anions

8. Explain the difference in solubility of ionic compounds

9. Be able to distinguish between an acid or a base in reactions taking place in aqueous/ non-aqueous solutions. Predictions of the acidic / basic character.

10. Being in a position to easily mass-charge balancing redox reactions, predict their direction, design galvanic-electrolytic cells, use of the Nerst equation and predict the stability of a given oxidation state.

11. Be familiarized with the basic principles of coordination chemistry so that they can (a) identify a complex compound and its isomers; (b) use the relevant bond theories to predict the hybridization, thermodynamic-kinetic stability, geometry, etc.

Knowledge

Knowledge and understanding of the basic concepts, principles and theories related to atomic and molecular structure, periodic properties of elements, chemical bonds, chemistry in aqueous and non-aqueous solutions, redox, coordination chemistry (at the introductory level).

Skills

Skills in predicting basic periodic properties of elements, the geometry of small molecules, solubility and salt precipitation conditions, redox reactions direction, identification and interpretation of all types of chemical bonds, prediction of the most stable Lewis acid-base pair, kinetic-thermodynamic data in inorganic reactions.

.

Advanced problem solving skills through careful analysis of the provided data.

Abilities

Ability to apply the knowledge provided to solve an inorganic chemistry problem at the introductory level.

Ability to predict basic periodic properties of the elements, thermodynamic-kinetic data evaluation, molecules geometry, solubility in aqueous and non-aqueous solutions, redox reactions direction.

Ability to identify the bond type present in inorganic compounds, and writing down the electron configuration of an atom/ion.

Ability to accurately assess - select the data provided to solve complex problems. Ability to work independently and to interact with other students.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competencies that the student should have acquired and to which the course is aimed are:

Search, analyze and evaluate data-information and make decisions.
Conversion of theory into practice.
Promote free, creative and inductive thinking.
Autonomous and teamwork as well.
Acquiring the appropriate theoretical background knowledge to enable further education both at a theoretical level (advanced topics of Inorganic Chemistry) and in a laboratory.

(3) SYLLABUS

Introduction to Inorganic Chemistry, (scope, linking to other areas (Biology, Physics, Materials Science)). Atomic Structure, the hydrogen atom, the Bohr theory, atomic orbitals, s, p, d orbitals, periodic table, elements properties periodicity. Chemical bond, orbitals overlap, σ, π and δ bonds, molecular orbitals. Homo- and heteronuclear diatomic molecules. Weak interactions. The geometry of molecules, Lewis Electron-Dot Formulas, Lewis structures, the Valence-Shell Electron-Pair Repulsion (VSEPR) model. The Valence bond theory (hybridization), three centers two electrons bonds. Ionic compounds, lattice energy, Born-Habber cycle, ionic radius, simple crystal structures. Chemistry of selected anions: oxides, hydroxides, alkoxides, polyoxo anions, halides, sulfides. Protic and non-protic solvents, molten salts, acids-bases definitions, solutions, protic acids, oxoacids. Redox chemistry: Writing and balancing half reactions in acidic and basic solutions. Galvanic and electrolytic cells. Introduction to Coordination Chemistry: Complexes molecular structure, ligands, nomenclature, isomerism. Bonding theories in complexes: Valence bond theory, Crystal field theory. Octahedral and tetrahedral complexes.The spectrochemical series, geometry distortion, square planar complexes. Molecular orbitals. Thermodymamic stability of the complexes. Hard and soft acids-bases. Complexes reactivity. Ligand(s) substitution reactions. Introduction to inorganic reaction mechanisms.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>e-mail communication with the students
Additional material on course website
http://ecourse.uoi.gr/course/view.php?id=756</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>lectures</td><td>52</td></tr>
<tr><td>Individual study, preparation</td><td>73</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total
(25 hours of workload per credit unit)</td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Students are evaluated (in Greek) either with two written examinations in the middle and at the end of the semester or for those who fail by the final written examination. The exams include questions and problems (multiple choice, short response, problem solving)</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography (most in Greek):

ΒΑΣΙΚΗ ΑΝΟΡΓΑΝΗ ΧΗΜΕΙΑ, F. ALBERT COTTON, GEOFFERY WILKINSON, PAUL GAUS, ΠΑΡΙΣΙΑΝΟΥ Α.Ε., 2016

Γενική Χημεία, EbbingGammon, (Μετάφραση Ν. Κλούρας), Εκδ. Τραυλός, 2002, ISBN 960-7990-66-8

Εισαγωγή στην Ανόργανη Χημεία, Ν. Χατζηλιάδης, 2010, ISBN 978-96093-2207-2

Ανόργανη Χημεία, Πέτρος Καραγιαννίδης, Εκδ. ΖΗΤΗ, 2008, ISBN 978-960-456-117-9

Inorganic Chemistry**,** Housecroft , Catherine E. 1955-, Sharpe , A. G. Harlow : Prentice Hall 2001.

Introduction to modern inorganic chemistry, Mackay , K. M. Kenneth Malcolm, Mackay , R. Ann Rosemary Ann 1938-, Henderson , W., Cheltenham, U.K. : Nelson Thornes c2002.

- Related academic journals

Inorganic Chemistry
European Journal of Inorganic Chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
DEPARTMENT	CHEMISTRY		
STUDY LEVEL	UNDERGRADUATE		
COURSE CODE	**XHY103**	**SEMESTER**	**1**
COURSE NAME	INDRODUCTORY LABORATORY OF CHEMISTRY		

TEACHING ACTIVITIES if credits are awarded in separate parts of the course eg Lectures, laboratory practicals, etc. If credits are awarded the same for the entire course, they should indicate the hours per week and the total of credits	**WEEKLY LECTURE HOURS**	**CREDITS**
	5	5
Προσθέστε σειρές αν χρειαστεί. Η οργάνωση διδασκαλίας και οι διδακτικές μέθοδοι που χρησιμοποιούνται περιγράφονται αναλυτικά στο (δ).		

TYPE OF COURSE general background, special background, specialization, general knowledge, developing skills	Scientific area / Developing skills
PREREQUISITE COURSES:	There are no prerequisites.
LANGUAGE TEACHING and EXAMINATION:	Greek
THE COURSE IS OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	It does not exist

(2) LEARNING OUTCOMES

Learning outcomes

The learning outcomes of the course, the specific knowledge, skills and abilities that will equip students after successful completion of the course are described

Refer to Appendix A

• Description of the Level of Learning Outcomes for each course according to the Qualifications Framework of the European Higher Education Area

• Indicators Descriptors Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Annex B.

- *Brief writing guide of Learning Outcomes*

- *The aim of the course is the teaching and consolidation of the principles of chemistry(analytical, inorganic and organic) through appropriate laboratory exercises and training of students on experimental chemistry techniques.*

After successfully completing the course, the students should:

1. Recognize the contribution of chemistry in the development of science in general.

2. Familiarize themselves with basic laboratory safety rules.

3. Familiarize themselves with the use of basic laboratory equipment.

4. Learn and understand basic principles of chemistry through the laboratory exercises.

5. Gain knowledge into basic experimental chemistry techniques.

6. Understand, through appropriate laboratory exercises, basic chemistry concepts such as solubility, redox chemistry, chemical equilibrium etc.

Knowledge

Knowledge and understanding of basic concepts, principles and theories related to the Analytical, Inorganic and Organic chemistry.

Skills

Development of skills on the proper use of basic laboratory equipment and basic experimental Analytical, Inorganic and Organic chemistry techniques.

Complex problem solving skills through careful analysis of the data provided.

Capacities

Ability to apply the knowledge provided in troubleshooting (theoretical and synthetic) relating to Analytical, Inorganic and Organic chemistry.

Ability to work safely in a chemistry laboratory.

Ability to use properly basic laboratory equipment.

Ability not only to work independently but also to interact with other students on the course topics.

General Skills

Taking into account the general competences to be acquired by the graduate (as listed in the DS and listed below) which of these skills the course are aimed at ?

Search, analysis and synthesis of data and information, the use and the necessary technologies
Adapting to new situations
Decision making
Autonomous work
Teamwork
Working in an international environment
Work in a multidisciplinary environment
Generate new research ideas

Design and project management
Respect for diversity and multiculturalism
Respect for the natural environment
Demonstrate social, professional and moral responsibility and sensitivity to gender issues
Criticism and self-criticism
Promotion of free, creative and inductive thinking
......
Other ...
....

The general skills that should be acquired by the student and in which the course aims at are:

Search, analysis and synthesis of data and information and making decisions.
Turning theory into practice.
Promotion of free, creative and inductive thinking.
Independent and teamwork.
Acquisition of the appropriate theoretical and practical knowledge base to enable the further training both in theory (in more specific subjects of Inorganic Chemistry) and in laboratory.

(3) COURSE SYLLABUS

Introduction to the practical knowledge of Qualitative Chemical Analysis Laboratory (rules and laboratory safety measures, work planning, keeping a laboratory book, cleanliness and tidiness, laboratory apparatus, reagents, selected reactions of cations and anions with various reagents). Way of expressing concentration of solutions and preparation of them, introduction to analytical separation of cations and anions, qualitative semi-microanalytical techniques (precipitation, extraction, evaporation, centrifugation, filtration, etc.). Introduction to the practical knowledge of the Laboratory of Quantitative Chemical Analysis (laboratory rules and safety measures, work planning, keeping a laboratory book, cleanliness and tidiness, laboratory apparatus, laboratory equipment materials, calibration of volumetric utensils, reagents, analytical balance, description and operation of analytical balance, analytical standards, general rules of use of the analytical balance, weighing with an analytical balance , weighing errors). Introduction to classical quantitative analysis methods (volumetric, gravimetric analysis).

Rules and safety measures in Inorganic Chemistry. Laboratory equipment and glassware. Reminding students about basic safety rules in the laboratory and demonstration of basic laboratory equipment to be used for conducting the laboratory exercises. Weighing. Dissolution, precipitation and filtration. Reactions of ions of alkaline earth. Study of the relative solubility of the alkaline earth metal ions. Oxidation and reduction. Redox chemistry of metals and halogens. Study of the relative solubility of silver salts of halogen ions. Use of reduction potentials table. Chemical equilibrium and Le Chatelier principle. Calculation of the equilibrium constant of a chemical reaction using a UV-Vis spectrometer.

Introduction to Organic Chemistry. Safety. Hazardous chemicals and precautions. Laboratory Equipment. Assembly of glassware. Acquaintance with organic compounds (liquid, solid, melting, coagulation, boiling, sublimation). Physical constants (boiling point, melting point), and their use in the identification of organic compounds. Solvents. Solubility of compounds. Filtration, drying of organic solvents and solid compounds. Typical reactions of functional groups of organic compounds and their identification by infrared spectroscopy.

(4) ΔΙΔΑΚΤΙΚΕΣ και ΜΑΘΗΣΙΑΚΕΣ ΜΕΘΟΔΟΙ - ΑΞΙΟΛΟΓΗΣΗ

LECTURE DELIVERY METHOD *Face to Face, distance learning κ.λπ.*	Face to Face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Using ICT in Teaching , Laboratory Training and in Communication with the students*	Electronic communication with students. Post-exercise additional notes etc. on the websites of teachers
ORGANIZING THE TEACHING *Describe in detail the methods of teaching. Lectures, Seminars, Laboratory Exercise, Field Exercise, Study and literature analysis, Tutorial, Practice (Placement), Clinical Practice, Art Workshop, Interactive teaching, Study Visits, Study (project), Writing job / work, Artistic*	

Δραστηριότητα	*Φόρτος Εργασίας Εξαμήνου*
Lectures	13
Laboratory exercise	52
Tutorial	30

<table>
<tr>
<td>creation etc.

Enter the hours of study for each student learning activity and hours of Non-guided study in accordance with the principles of ECTSΕργαστήριο, Διαδραστική διδασκαλία, Εκπαιδευτικές επισκέψεις, Εκπόνηση μελέτης (project), Συγγραφή εργασίας / εργασιών, Καλλιτεχνική δημιουργία, κ.λπ.

Αναγράφονται οι ώρες μελέτης του φοιτητή για κάθε μαθησιακή δραστηριότητα καθώς και οι ώρες μη καθοδηγούμενης μελέτης σύμφωνα με τις αρχές του ECTS</td>
<td>
<table>
<tr><td>Writing work</td><td>30</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>TOTAL</td><td>125</td></tr>
</table>
</td>
</tr>
<tr>
<td>STUDENT EVALUATION

Description of the evaluation process

Assessment Language, Methods of assessment Formative or Concluding, Test Multiple Choice, Questions Short Answer, Development Questions Essays, Problem Solving, Written Work, Report / Report, Oral Examination, Public Presentation, Laboratory Work, Clinical Examination Patient Artistic Interpretation Other / other

Indicate clearly defined evaluation criteria and whether and which are accessible to students.</td>
<td>The students are graded based on their assignments in the context of the laboratory exercises, oral and / or a short written examination during the laboratory course and through written examinations at the end of the semester. Their assignments include the development of basic theory-purpose of the exercises, the experimental procedure and analysis-interpretation of results. The final exam include:
Short Answer Questions, crisis, development, and problem solving

All these criteria are explained to students at the start of the course.</td>
</tr>
</table>

(5) SUGGESTED LITERATURE

-Προτεινόμενη Βιβλιογραφία :

ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΓΕΝΙΚΗΣ ΚΑΙ ΑΝΟΡΓΑΝΗΣ ΧΗΜΕΙΑΣ, ΑΚΡΙΒΟΣ ΠΕΡΙΚΛΗΣ, ΚΑΡΑΓΙΑΝΝΙΔΗΣ ΠΕΤΡΟΣ, ΖΗΤΗ ΠΕΛΑΓΙΑ ΚΑΙ ΣΙΑ Ο.Ε.

ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΓΕΝΙΚΗΣ ΚΑΙ ΑΝΟΡΓΑΝΗΣ ΧΗΜΕΙΑΣ, ΛΑΛΙΑ - ΚΟΝΤΟΥΡΗ ΜΑΡΙΑ, ΠΑΠΑΣΤΕΦΑΝΟΥ ΣΤΕΡΓΙΟΣ, ΤΖΑΒΕΛΛΑΣ Λ., ΧΑΤΖΗΚΩΣΤΑΣ ΧΡ., ΖΗΤΗ ΠΕΛΑΓΙΑ ΚΑΙ ΣΙΑ Ο.Ε.

ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΓΕΝΙΚΗΣ ΚΑΙ ΑΝΟΡΓΑΝΗΣ ΧΗΜΕΙΑΣ, Μ. ΛΟΥΛΟΥΔΗ, Τ. ΤΑΣΙΟΠΟΥΛΟΣ, Σ. ΧΑΤΖΗΚΑΚΟΥ, Ν. ΧΑΤΖΗΛΙΑΔΗΣ, Σ. ΧΑΤΖΗΚΑΚΟΥ

ΣΗΜΕΙΩΣΕΙΣ ΕΙΣΑΓΩΓΙΚΟΥ ΕΡΓΑΣΤΗΡΙΟΥ ΧΗΜΕΙΑΣ. Παραδόσεις και ασκήσεις αναλυτικής χημείας για το μάθημα «Εισαγωγικό Εργαστήριο Χημείας»

-Συναφή επιστημονικά περιοδικά:

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	CHEMISTRY DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHY 022**	**SEMESTER**	**2**
COURSE TITLE	INORGANIC CHEMISTRY II		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific Area / Special Background / Development Skills
PREREQUISITE COURSES:	NONE
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://users.uoi.gr/iplakatu/site/ARXIKH.htm http://users.uoi.gr/shadjika/Hadjikakou_1/Hadjikakou_08.htm

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, descriptive marker 6 of the European Qualifications Framework, students should be able to:

- Understand ways of interacting transition metals with ligands.
- Understand the role of coordination compounds in life and technology.
- Understand ligand exchange reactions.
- Understand the basic principles of bond theories and their application to Coordination Chemistry.
- Understand the relationship between bond theories and reactions involving metal complexes.
- Understand the spectroscopic and magnetic properties of coordination compounds.
- Understand the imperfections of some bond theories and choose the appropriate theory for use.
- The second part of the course covers the part of the matter of Inorganic Chemistry referring to the chemical elements of the main groups of the periodic table and their compounds. In this lesson, young chemists meet with to the most important new developments in inorganic chemistry. The presentation of the properties of the chemical elements and their compounds is done in a systematic manner according to the groups of the periodic table. The presentation method is comparative. Each chapter develops

both the normal and the unusual behaviour of certain elements. In the manufacturing processes, the main treatments necessary for the isolation of the elements are generally reported. Along with the reference to new methods of manufacturing certain elements and their compounds, they develop their most characteristic chemical properties as well as their most important applications in other fields of science and technology. Finally, the student has the notes in a modern way of presenting the chapters to be examined

Knowledge

- Knowledge and understanding of basic and advanced principles of coordination chemistry.
- Knowledge and understanding of all bond theories applied to complexes.
- Knowledge and understanding of the evolution of bond theories, and their imperfections.
- Knowledge and understanding of complex formation and substitution reactions.
- Knowledge and understanding of the relationships between structure and reactivity of the complexes
- Knowledge and understanding of spectroscopic and magnetic properties of coordination compounds.
- Knowledge of structure and properties of various compounds containing metals.
- Knowledge of the most important new developments in inorganic chemistry.
- Knowledge of the properties of the chemical elements and their compounds
- Knowledge of both the normal and unusual behaviour of certain elements.
- Knowledge of the manufacturing processes, the main treatments necessary to isolate the elements.

Skills

- Skills to solve problems related to coordination chemistry.
- Skills to solve problems related to structural coordination chemistry.
- Skills to solve problems related to the reactivity of complex compounds.
- Skills to solve problems associated with spectroscopy and magnetism in complexes.

Abilities

- Ability to apply their knowledge in addressing issues related to coordination chemistry.
- Ability to combine bibliographic / experimental data and provide for chemical reaction products containing complexes.
- Ability to interact with other students or researchers in the field of coordination chemistry and transition metals.
- Ability to select and apply relevant methodology for solving a particular spectroscopic and / or magnetochemical problems involving a metal center.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competencies that the student should have acquired and to which the course is aimed are:

- Theoretical thinking and ability to translate theory into practice.
- Ability to apply knowledge acquired during the study period and related courses of the curriculum of the Department of Chemistry.
- Ability to search, analyze and synthesize data and information from international literature and use the necessary technologies related to the presentation of research results.
- Acquiring the appropriate theoretical and practical knowledge base to allow further education at the postgraduate level of specialization and doctorate.
- Working in an interdisciplinary environment.

- Ability to work together at team level to achieve these goals.

(3) SYLLABUS

Nature and type of elements in the periodic table. Single, dual and polyatomic elements Extensive structures. Metals. Chemistry of the elements in relation to their position in the periodic table. Elements of 1st, 2nd period, master group elements, transition elements, f-elements. Hydrogen, hydrides, molecular and atomic hydrogen reactions, applications. Elements of the 1st group of the IP Binary compounds, hydroxides, salts. Inclusion associations. Organometallic salts and applications. Elements of the 2nd Group of the IP Binary compounds, hydroxides, salts. Integration associations. Organometallic salts and applications. Beryllium. Boron. Oxygen compounds, halides, hydrides, boron-nitrogen compounds. Al, Ga, In, Tl. Carbon. Graphite, diamond, fuller and carbide. Carbon oxides. Carbonic acid and oxyacids. Metallocarbonyls and organometallic compounds. Silicon. Comparison of C-Si. Silicones, silicones. Ge, Sn, Pb. Nitrogen. Nitrides, hydrides, oxides. Halogenated. Acids. Phosphorus. Oxides, oxy compounds. As, Sb, Bi. Oxygen. Properties, allotropic forms. Oxides, peroxides, superoxides. Complexation of O2. Molecular oxygen-breathing vectors. Sulfur. Properties, allotropic forms. Sulfides, polysulfides. Oxides, oxyacids. Se, Te, Po. Halogen. Halogenated. Oxides. Oxyacids. Noble gases. Properties. Foreign: compounds Zn, Cd, Hg. Transition metals). Theory of the Field of Substituters. Molecular orbits. Magnetic properties. Molecular orbits. Magnetic properties. Introduction to compounds with M-M bonds. Ti, Zr, Hf. V, biological role, Nb, Ta. Cr, peroxo-chromium compounds, Mo, W, biological role. Mn, Tc, Re. Fe, Co, Ni, biological role, applications. Cu, Ag, Au, biological role, applications. Platinum group metals. Ru, Os, Rh, Ir, Pd, Pt. Sc, Y, La, Lanthanides. Kiwi. Integration chemistry. Stochastic Theory, Crystalline Field Theory and Field Theory of Substituters. Structure of complexes. AE = 2, AE = 3, AE = 4. AE = 5, AE = 6. Distortions from ideal geometry. Greater coordination numbers. Chelation phenomenon. Methodology for classifying inclusion compounds.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Classroom
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	**e-mail, Powerpoint**
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Student evaluation is made through progress exams during the course and written final examination (evaluation) in Greek which includes: Theoretical questions Multiple choice questions Responses to questions of judgement Problem solving.

Activity	*Semester workload*
Lectures, tutoring	52
Study, preparation	73
Course total	***125***

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

1. Basic inorganic chemistry, (in greek) F. Albert Cotton, Geoffery Wilkinson, Paul Gaus, ed. Parisianou, 2015
2. Advanced Inorganic Chemistry, F.A. Cotton, G. Wilkinson, C. A. Murillo, M. Bochmann, John Wiley and sons, 1999.
3. INORGANIC CHEMISTRY (IN GREEK), C. E. HOUSECROFT, A. G. SHARPE,
4. Inorganic Chemistry (in Greek), James E. Huheey, Harper Collins Eds., 3rd ed., 1983
5. Chemistry Principles, Nick Hadjiliadis

Related Journals
ACS: JACS, Inorganic Chemistry
RSC: Dalton Trans., Chem. Commun., New J. Chem, RSC Advances
Elsevier: Polyhedron, Inorg. Chim. Acta, Inorg. Chem. Commun.
Wiley: European Journal of Inorganic Chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	CHEMISTRY		
LEVEL OF STUDIES	POSTGRGRADUTE		
COURSE CODE	**ΦΘΧ7**	**SEMESTER**	**B**
COURSE TITLE	PHYSICAL CHEMISTRY OF POLYMERS		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).	2	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special Background
PREREQUISITE COURSES:	There are not prerequisite courses in the Chemistry Department
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (There is a possibility of teaching in English depending on the audience)
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (In English)
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successful completion of the course, students should be able to:

Understand the basic principles of modelling of a single polymer chain by coarse graining and atomistic models.

To understand the achievements and limitations of Flory theory for polymer melts and blends.

To understand the principles of light scattering

Knowledge of:

-what is the Kuhn length

-what is the C infinity

-what is the radii of gyration and the end-to-end square distance

-what is probability distribution function

-what is the scaling law

What is the stability condition is polymer blends

What is the glass transition temperature

Skills:

To use the experimental data in order to extract the necessary parameters for polymer modelling.

To apply previous knowledge from mathematics in the study of real systems

Abilities:

-Ability to calculate the number of segments of real polymers from experimental data.

- Ability to calculate the radius of gyration of polymers with complex architecture with the random walk model

-Ability to use the equations of states

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The course aims students to acquire special knowledge in physical chemistry of polymers necessary to cope with the latest developments in chemical science. It also aims to develop critical thinking and familiarization of students with contemporary subjects in the theoretical and experimental fields of science.

-Advance collaboration between students to understand each subject and discover ways to cope with,

-search for complementary solutions and evaluate critical thinking for a proper choice between available “tools” and

-plan and deal with a sufficient number of problems to better gain self-reliance and confidence with the "modern" way of thinking.

(3) SYLLABUS

1) **Polymer chain conformation: Basic principles, Simple models of flexible chains, the Gaussian chain, Kuhn length, excluded volume, dilute solutions, Two parameters theory, renormalization group theory, scaling laws in polymer physics, virial coefficients, Radius of gyration, Effects of architecture of polymer chain, Hydrodynamic theories of dilute solutions, viscosity.**
2) **Introduction to the rotational isomeric state model.**
3) **Light Scattering**
4) **Flory lattice theory, Phases equilibrium , Various equations of states**
5) **Solid state properties of polymers**

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	**Power point presentations**
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	

Activity	***Semester workload***
Teaching	26
Individual study	65
Assignments	59
Course total	***150***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Evaluation will be by final written examination, which will cover all the semester's work (60% of the final grade) and the assignments during the course (40% of the final grade). The passing grade for the course is 50%,

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

Iwao Teraoka Polymer Solutions. An Introduction to Physical Properties. Wiley-Interscience
Paul Hiemenz & Timothy Lodge Polymer Chemistry. CRC Press
M. Rubinstein & Ralph H. Colby Polymer Physics. Oxford University Press

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHY017**	**SEMESTER**	**B′**
COURSE TITLE	Organic Chemistry I		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
LECTURES	4	5
	0	0
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Background knowledge
PREREQUISITE COURSES:	According to the curriculum of the Department of Chemistry there are no prerequisites.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	-

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, level descriptor 6 of the European Qualifications Framework, students should be able to:

- Understand the basic principles of the hybridization of carbon and, more generally, heteroatoms and the molecular structure of organic molecules.
- Understand the concepts of covalent, polar and semi-polar bond.
- To understand the basics of the resonance theory and the theory of molecular orbitals.
- Understand the concept of electronegativity and dipole moment.
- Understand the concept of electronic phenomena (inductive, conjugation, hyperconjugation) and be able to distinguish them.
- Understand the concept of steric phenomena.
- Understand the concept of the stereogenic center and consequently the concept of the configuration and the stereochemical representation of the molecules (stereochemistry).
- Understand the concept of acidity and basicity in organic molecules.
- Understand the meaning of the strength of the chemical bond and its dissociation energy.
- Understanding the substitution-elimination reactions and the factors affecting them

(substrate, temperature, nucleophile, etc.). The nature of the transition state in combination with their kinetics.

- Understand the characteristics of the functional groups (alkenes-alkyne-dienes) and the type of reactions they give. Their thermochemical stability. The concept of regioselectivity and stereochemistry in their reactions, based on the established mechanisms of the basic reactions.

Knowledge

- Knowledge and understanding of basic concepts of hybridization, atomic and molecular orbitals of the carbon atom and heteroatoms of interest in Organic Chemistry.
- Knowledge of different categories of chemical bonds.
- Elementary knowledge of resonance theory and molecular orbital theory.
- Knowledge of electronic phenomena (inductive, conjugation, hyperoconjugation) and steric phenomena.
- Knowledge of the concepts of acidity and basicity as applied to organic compounds.
- Knowledge and understanding of the concept of stereochemistry of organic molecules [Chirality, optical activity, enantiomers, diastereomers, meso-compounds, racemic mixtures. stereo display, Fischer projection, nomenclature (R / S)].
- Knowledge of nomenclature, synthetic routes, basic chemical reactions and mechanisms of alkenes, alkynes, dienes, as well as, the Substitution- Elimination reactions.

Skills

- Skills in predicting structures of organic compounds.
- Skills in predicting the formation and stereochemistry of organic compounds.
- Skills in the distinction and prediction of electronic phenomena.
- Skills in prediction of acidity-basicity properties of organic compounds.
- Skills to predict the mechanism of substitution, addition reactions, and expected reaction products.

Competences

- Ability to predict and interpret structures of organic compounds.
- Ability to predict and interpret electronic phenomena of importance in organic compounds.
- Ability to predict and interpret the acidity and basicity properties of organic compounds.
- Ability to predict and interpret the mechanisms of substitution, addition, and elimination reactions.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competences that the student should have acquired and to which the course is aimed are:

- Ability to apply the knowledge acquired during the study period in other related courses of the curriculum of the Department of Chemistry.

(3) SYLLABUS

Structure and molecular properties. Acids and bases (Brønsted-Lowry and Lewis definition). Distribution of organic compounds according to their functional groups. Design of chemical structures, molecular models. Basics of the resonance theory and the theory of molecular orbitals. Alkanes, cycloalkanes (nomenclature, configurations, projections, properties and reactions thereof). Substituted cycloalkanes. Stereochemistry. Overview of organic reactions. Reaction rate, chemical equilibrium, bond dissociation energy, energy diagrams. Inductive, conjugation and hyperconjugation phenomena. Stereochemistry of organic compounds. Chirality, optical activity, enantiomers, diastereomers, meso-compounds, racemic mixtures. Stereo display, Fischer projects, nomenclature (R / S). Alkenes. Structure, nomenclature, cis / trans isomerism (Z / E). Hydrogenation heat, stability of alkenes. Alkene preparations, properties and reactions. Structure and stability of carbocations. Alkene-derivative reactions. Dienes. Alkynes. Nomenclature, properties, preparations and reactions. Alkyl halides [Nomenclature, physical and chemical properties, preparations. Nuclear substitution reactions (SN1 and SN2). Elimination reactions (E1 and E2)].

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of Technologies of Information and communications in teaching and communication with students.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below

Activity	***Semester workload***
Lectures	85
Written assignment	15
Individual study, preparation	25
Course total	**125**

STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.

Written examination (80%) in Greek with a combination of open-ended questions, multiple choice questionnaires, short-answer questions and written work with public presentation (20%).

The evaluation of the students is done by written final examination (evaluation) in Greek which includes:

A) Written examinations during semester development topics

- short answer questions
- answers to critical questions
- problem solving

B) Written final exam including:

- Development of issues
- short answer questions
- answers to critical questions
- problem solving.

(5) ATTACHED BIBLIOGRAPHY

- Books:

- Organic Chemistry, J. McMurry, 9th edition, University Publications of Crete (2017)
- Organic Chemistry "Morrison and Boyd", Greek translation, volume A , K. Savarellos, G. Pelidis, I. Gerothanasis, University of Ioannina (1988).
- Organic Chemistry, Peter Vollhardt - Neil Schore, 7th edition, volume A, Kyriakidis Brothers Publications (2017).
- Organic Chemistry (7th edition), L. G. Wade Jr., A. Tziola Publications (2012).
- Organic Chemistry (Volume I), David Klein, Utopia Publications LTD (2015)
- Basic Principles of Organic Chemistry, 2nd Edition, John D. Roberts, Marjorie C. Caserio, W.A. Benjamin, Inc. (1977).

- Proposed Electronic Bibliography:

- *http://chemwiki.ucdavis.edu/Wikitexts/Purdue/Purdue%3A_Chem_26505/Chapter_3._Stereochemistry*
- *http://chemwiki.ucdavis.edu/Wikitexts/Purdue/Purdue%3A_Chem_26505/Chapter_8._Acid-Base_Reactions*
- *http://walba.colorado.edu/2010_Chem_3311/Stereochem%20Vids.html*
- *http://nsmn1.uh.edu/miljanic/lec6.swf*
- *http://higheredbcs.wiley.com/legacy/college/klein/0471756148/videos/files/ch05/single_bonds_rotate/single_bonds_rotate/Single_Bonds_Rotate.swf*
- *http://handbook.free.fr/telechargement/cours/cyclohexane.swf*
- *http://sitemaker.umich.edu/medchemlibrary/files/stereochemistry_calm_module_johnz.swf*
- *https://www.youtube.com/watch?v=I665n1HC7tY*

- Scientific Journals:

- Journal of Chemical Education

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences
ACADEMIC UNIT	Department of Chemistry
LEVEL OF STUDIES	Undergraduate

COURSE CODE	**XHY 201 (2.1)**	**SEMESTER**	**2nd**

COURSE TITLE	**Analytical Chemistry II**

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background, specialization, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on analytical chemistry topics relevant to the analytical process, measurements, apparatus and unit operations of analytical chemistry, experimental errors in chemical analysis, statistical data treatment and evaluation, introduction to analytical separations, gravimetric methods of analysis, titrimetric methods, precipitation titrimetry, principles of neutralization titrations, titrations curves of complex qacid/base systems, applications of neutralization titrations, complexation reactions and titrations. They will learn how to search in literature and analyze data using new technologies. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism

Working in an international environment *Working in an interdisciplinary environment* *Production of new research ideas*	*Production of free, creative and inductive thinking* *……* *Others…* *…….*
Search, analysis and synthesis of data and information, by using the proper technologies. Working independently Team work Respect of natural environment Promoting free, creative and inductive thinking Understanding analytical science, demonstrate a coherent understanding of analytical chemistry Depth and breadth of analytical chemistry knowledge Inquiry and problem solving, critically analyse and solve problems in analytical chemistry Personal and professional responsibility, be accountable for individual learning and scientific work in analytical chemistry	

(3) SYLLABUS

The analytical process, measurements, apparatus and unit operations of analytical chemistry, experimental errors in chemical analysis, statistical data treatment and evaluation, introduction to analytical separations, gravimetric methods of analysis, titrimetric methods, precipitation titrimetry, principles of neutralization titrations, titrations curves of complex qacid/base systems, applications of neutralization titrations, complexation reactions and titrations

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Written assignment</td><td>30</td></tr>
<tr><td>Not guided study</td><td>43</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Written examination (80%) in Greek.
Written work withpublic presentation (20%).</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography: :

ΠΟΣΟΤΙΚΗ ΑΝΑΛΥΣΗ	Θ.Π. ΧΑΤΖΗΪΩΑΝΝΟΥ, Α.ΚΑΛΟΚΑΙΡΙΝΟΣ, Μ. ΤΙΜΟΘΕΟΥ-ΠΟΤΑΜΙΑ	ΕΛΕΝΗ ΧΑΤΖΗΪΩΑΝΝΟΥ
ΣΗΜΕΙΩΣΕΙΣ ΜΑΘ. ΠΟΣΟΤΙΚΗΣ ΧΗΜΙΚΗΣ ΑΝΑΛΥΣΗΣ	*Α. ΒΛΕΣΣΙΔΗΣ*	*ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)*
ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΜΕΘΟΔΟΙ ΠΟΣΟΤΙΚΗΣ ΧΗΜΙΚΗΣ ΑΝΑΛΥΣΗΣ	ΣΤΡΑΤΗΣ ΙΩΑΝΝΗΣ, ΖΑΧΑΡΙΑΔΗΣ ΓΕΩΡΓΙΟΣ Α. ΒΟΥΛΓΑΡΟΠΟΥΛΟΣ	ΖΗΤΗ ΠΕΛΑΓΙΑ ΚΑΙ ΣΙΑ Ο.Ε.
ΣΗΜΕΙΩΣΕΙΣ ΜΑΘ. ΠΟΣΟΤΙΚΗΣ ΧΗΜΙΚΗΣ ΑΝΑΛΥΣΗΣ	*Α. ΒΛΕΣΣΙΔΗΣ*	*ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)*
ΑΝΑΛΥΤΙΚΗ ΧΗΜΕΙΑ	ΛΙΟΔΑΚΗΣ ΣΤΥΛΙΑΝΟΣ	ΕΚΔΟΣΕΙΣ ΠΑΠΑΣΩΤΗΡΙΟΥ
ΣΗΜΕΙΩΣΕΙΣ ΜΑΘ. ΠΟΣΟΤΙΚΗΣ ΧΗΜΙΚΗΣ ΑΝΑΛΥΣΗΣ	*Α. ΒΛΕΣΣΙΔΗΣ*	*ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)*

Fundamentals of Analytical Chemistry 9th Edition, Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Brooks/Cole (2014)

Quantitative Chemical Analysis, 9th Edition, Daniel C. Harris, Wiley (2015)

- Related academic journals:

1) Analytical Chemistry
2) Journal of Chromatography
3) AnalyticaChimicaActa
4) Talanta

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	CHEMISTRY DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHY 022**	**SEMESTER**	**2**
COURSE TITLE	INORGANIC CHEMISTRY II		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
		4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific Area / Special Background / Development Skills		
PREREQUISITE COURSES:	NONE		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://users.uoi.gr/iplakatu/site/ARXIKH.htm http://users.uoi.gr/shadjika/Hadjikakou_1/Hadjikakou_08.htm		

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, descriptive marker 6 of the European Qualifications Framework, students should be able to:

- Understand ways of interacting transition metals with ligands.
- Understand the role of coordination compounds in life and technology.
- Understand ligand exchange reactions.
- Understand the basic principles of bond theories and their application to Coordination Chemistry.
- Understand the relationship between bond theories and reactions involving metal complexes.
- Understand the spectroscopic and magnetic properties of coordination compounds.
- Understand the imperfections of some bond theories and choose the appropriate theory for use.
- The second part of the course covers the part of the matter of Inorganic Chemistry referring to the chemical elements of the main groups of the periodic table and their compounds. In this lesson, young chemists meet with to the most important new developments in inorganic chemistry. The presentation of the properties of the chemical elements and their compounds is done in a systematic manner according to the groups of the periodic table. The presentation method is comparative. Each chapter develops

both the normal and the unusual behaviour of certain elements. In the manufacturing processes, the main treatments necessary for the isolation of the elements are generally reported. Along with the reference to new methods of manufacturing certain elements and their compounds, they develop their most characteristic chemical properties as well as their most important applications in other fields of science and technology. Finally, the student has the notes in a modern way of presenting the chapters to be examined

Knowledge

- Knowledge and understanding of basic and advanced principles of coordination chemistry.
- Knowledge and understanding of all bond theories applied to complexes.
- Knowledge and understanding of the evolution of bond theories, and their imperfections.
- Knowledge and understanding of complex formation and substitution reactions.
- Knowledge and understanding of the relationships between structure and reactivity of the complexes
- Knowledge and understanding of spectroscopic and magnetic properties of coordination compounds.
- Knowledge of structure and properties of various compounds containing metals.
- Knowledge of the most important new developments in inorganic chemistry.
- Knowledge of the properties of the chemical elements and their compounds
- Knowledge of both the normal and unusual behaviour of certain elements.
- Knowledge of the manufacturing processes, the main treatments necessary to isolate the elements.

Skills

- Skills to solve problems related to coordination chemistry.
- Skills to solve problems related to structural coordination chemistry.
- Skills to solve problems related to the reactivity of complex compounds.
- Skills to solve problems associated with spectroscopy and magnetism in complexes.

Abilities

- Ability to apply their knowledge in addressing issues related to coordination chemistry.
- Ability to combine bibliographic / experimental data and provide for chemical reaction products containing complexes.
- Ability to interact with other students or researchers in the field of coordination chemistry and transition metals.
- Ability to select and apply relevant methodology for solving a particular spectroscopic and / or magnetochemical problems involving a metal center.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competencies that the student should have acquired and to which the course is aimed are:

- Theoretical thinking and ability to translate theory into practice.
- Ability to apply knowledge acquired during the study period and related courses of the curriculum of the Department of Chemistry.
- Ability to search, analyze and synthesize data and information from international literature and use the necessary technologies related to the presentation of research results.
- Acquiring the appropriate theoretical and practical knowledge base to allow further education at the postgraduate level of specialization and doctorate.
- Working in an interdisciplinary environment.

- Ability to work together at team level to achieve these goals.

(3) SYLLABUS

Nature and type of elements in the periodic table. Single, dual and polyatomic elements Extensive structures. Metals. Chemistry of the elements in relation to their position in the periodic table. Elements of 1st, 2nd period, master group elements, transition elements, f-elements. Hydrogen, hydrides, molecular and atomic hydrogen reactions, applications. Elements of the 1st group of the IP Binary compounds, hydroxides, salts. Inclusion associations. Organometallic salts and applications. Elements of the 2nd Group of the IP Binary compounds, hydroxides, salts. Integration associations. Organometallic salts and applications. Beryllium. Boron. Oxygen compounds, halides, hydrides, boron-nitrogen compounds. Al, Ga, In, Tl. Carbon. Graphite, diamond, fuller and carbide. Carbon oxides. Carbonic acid and oxyacids. Metallocarbonyls and organometallic compounds. Silicon. Comparison of C-Si. Silicones, silicones. Ge, Sn, Pb. Nitrogen. Nitrides, hydrides, oxides. Halogenated. Acids. Phosphorus. Oxides, oxy compounds. As, Sb, Bi. Oxygen. Properties, allotropic forms. Oxides, peroxides, superoxides. Complexation of O2. Molecular oxygen-breathing vectors. Sulfur. Properties, allotropic forms. Sulfides, polysulfides. Oxides, oxyacids. Se, Te, Po. Halogen. Halogenated. Oxides. Oxyacids. Noble gases. Properties. Foreign: compounds Zn, Cd, Hg. Transition metals). Theory of the Field of Substituters. Molecular orbits. Magnetic properties. Molecular orbits. Magnetic properties. Introduction to compounds with M-M bonds. Ti, Zr, Hf. V, biological role, Nb, Ta. Cr, peroxo-chromium compounds, Mo, W, biological role. Mn, Tc, Re. Fe, Co, Ni, biological role, applications. Cu, Ag, Au, biological role, applications. Platinum group metals. Ru, Os, Rh, Ir, Pd, Pt. Sc, Y, La, Lanthanides. Kiwi. Integration chemistry. Stochastic Theory, Crystalline Field Theory and Field Theory of Substituters. Structure of complexes. AE = 2, AE = 3, AE = 4. AE = 5, AE = 6. Distortions from ideal geometry. Greater coordination numbers. Chelation phenomenon. Methodology for classifying inclusion compounds.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>**DELIVERY**
Face-to-face, Distance learning, etc.</td><td>Classroom</td></tr>
<tr><td>**USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**
Use of ICT in teaching, laboratory education, communication with students</td><td>**e-mail, Powerpoint**</td></tr>
<tr><td>**TEACHING METHODS**
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>*Activity*</th><th>*Semester workload*</th></tr>
<tr><td>Lectures, tutoring</td><td>52</td></tr>
<tr><td>Study, preparation</td><td>73</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>***125***</td></tr>
</table>
</td></tr>
<tr><td>**STUDENT PERFORMANCE EVALUATION**
Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>Student evaluation is made through progress exams during the course and written final examination (evaluation) in Greek which includes:
Theoretical questions
Multiple choice questions
Responses to questions of judgement
Problem solving.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

1. Basic inorganic chemistry, (in greek) F. Albert Cotton, Geoffery Wilkinson, Paul Gaus, ed. Parisianou, 2015
2. Advanced Inorganic Chemistry, F.A. Cotton, G. Wilkinson, C. A. Murillo, M. Bochmann, John Wiley and sons, 1999.
3. INORGANIC CHEMISTRY (IN GREEK), C. E. HOUSECROFT, A. G. SHARPE,
4. Inorganic Chemistry (in Greek), James E. Huheey, Harper Collins Eds., 3rd ed., 1983
5. Chemistry Principles, Nick Hadjiliadis

Related Journals
ACS: JACS, Inorganic Chemistry
RSC: Dalton Trans., Chem. Commun., New J. Chem, RSC Advances
Elsevier: Polyhedron, Inorg. Chim. Acta, Inorg. Chem. Commun.
Wiley: European Journal of Inorganic Chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHY 035**	**SEMESTER**	**3**
COURSE TITLE	LABOARATORY OF INORGANIC CHEMISTRY I		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific Area / Special Background / Development Skills
PREREQUISITE COURSES:	NONE
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	NONE

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

- The aim of the course is to teach and consolidate basic principles of inorganic chemistry through appropriate laboratory exercises and to teach students synthetic and characterization techniques of inorganic compounds
- After successful completion of the course, students should be able to:

1. Recognize the contribution of inorganic chemistry to the development of chemistry and other related disciplines.
2. Be able to prepare coordination compounds using appropriate synthetic methods.
3. Be able to isolate coordination compounds in pure form using appropriate purification methods.
4. Know some characteristic properties (geometry, coordination, etc.) of different metal ions.
5. Understand geometric isomerism (e.g., cis, trans) in coordination compounds.
6. Know basic principles (stability of oxidative states, kinetics, etc.) regarding transition metals coordination chemistry such as Cu^{2+}, $Co^{2+/3+}$
7. Identify different ways of ligands (monodentate, chelate, bridging etc).
8. Explain basic infrared and UV/visible spectroscopic data of inorganic compounds and lead to conclusions on the way ligands are coordinated, geometry, isomerism, symmetry, crystal field splitting, etc
9. Be able to calculate the yield of reactions involving the synthesis of coordination compounds.
10. Understand basic principles of magnetochemistry of coordination compounds, be able to

perform magnetic susceptibility measurements at room temperature, calculate the effective magnetic moment and thus be able to draw conclusions about oxidation state of metal ions and discrimination in low-high spin compounds.

11. Be aware of the basic principles of coordination chemistry so that (a) can easily draw a complex compound and its isomers; (b) use relevant bond theories to predict the hybridization, thermodynamic-kinetic stability geometry , etc. for certain complexes

Knowledge

Knowledge and understanding of the basic concepts, principles and theories related to the composition and physico-chemical characterization of coordination compounds.

Skills

Skills in the synthesis and purification of coordination compounds, use of spectrometers and magnetic balances, interpretation of infrared and visible-ultraviolet spectra, processing of magnetic susceptibility data at room temperature.

Advanced problem solving skills through careful analysis of the provided data.

Abilities

Ability to apply the knowledge provided in solving problems (theoretical and synthetic) related to Inorganic Chemistry.

Ability to synthesize coordination compounds in pure form.

Ability to use spectrometers and magnetic scales.

Ability to interpret spectroscopic data.

Ability to work independently and to interact with other students on the subject.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competencies that the student should have acquired and to which the course is aimed are:

Search, analyze and synthesize data and information and make decisions.

Conversion of theory into practice.

Promote free, creative and inductive thinking.

Autonomous but also teamwork.

Acquiring the appropriate theoretical and practical knowledge base to enable further education both at a theoretical level (in more specific topics of Inorganic Chemistry) and in a laboratory.

(3) SYLLABUS

Introduction to the Lab. Safety measures. Demonstration of glassware and instruments. Synthesis of M(acac)$_3$ (M = Mn, Cr, Al), Na(acac), recrystallization, M-O, C-O bond strength studied by infrared spectroscopy. Synthesis of $(Et_4N)_2[NiCl_4]$, and $[Ni(NH_3)_6]Cl_2$. Synthesis of Ni(dmgH)$_2$]. Study of the magnetic properties of Ni(II) tetrahedral, octahedral and square planar complexes. Synthesis of [CoCl$_2$(qui)$_2$]. Tetrahedral-octahedral complex equilibrium study with visible spectroscopy. Synthesis and purification of SnI_4. Reflux. Synthesis of oxalate hydrates of group 2. Thermal analysis of hydrated oxalates of group 2.

In particular, the course consists of the following subjects:

1. INTRODUCTION TO THE LABORATORY

To educate students on the basic safety rules in the laboratory and to demonstrate the basic laboratory equipment to be used for the laboratory exercises. Lab book.

2. INTRODUCTION TO THE BASIC PRINCIPLES OF SPECTROSCOPY and MAGNETOCHEMISTRY

Basic principles of infrared and visible spectroscopy are presented, as well as principles of magnetochemistry of coorination compounds. Examples are given regarding the use of the above techniques in inorganic chemistry.

3. CHELATED COMPLEXES. SYNTHESIS OF M(acac)$_3$ (M = Mn, Cr, Al) (4 Laboratory exercises).

The purpose of the experiment is to synthesize and characterize the Mn(acac)$_3$ and Cr(acac)$_3$

complexes. Product isolation, Gooch filtering, filter rinsing. Quality control by measuring the melting point. Yield calculation.
The experiment intends in particular to demonstrate
(a). The use of basic laboratory techniques.
(B). The use of chelating ligands in complexes.
(C). The slow kinetics of Cr(III) reactions and the particularities in the use of basic reagents. Use of urea for ammonia production.
(C) Different starting materials in manganese chemistry. Preparing Mn(III) by the reaction of Mn(II) and Mn(VII).
(E) The composition of $Al(acac)_3$ is at the initiative of the students. Use of knowledge gained from previous experiments.
(F) Solids purification. Recrystallization. Yield Calculation.
(G) Characterization by infrared spectroscopy. Characteristic peaks, similarities to spectral differences. Relative strength of M-O and C-O bonds
4. THE CHEMISTRY OF Ni(II) ION. COORDINATION GEOMETRIES and MAGNETIC CHARACTERISTICS (4 laboratory exercises).
The purpose of the laboratory exercises is the synthesis and characterization of three Nickel complexes with 3 different geometries: octahedral, tetrahedral and square planar. Yield calculation. Use of dehydrating agents in reaction systems.
Then study their magnetic properties. Measure their magnetic susceptibility and calculate their magnetic moment. Conclusions about their electronic structures from their magnetic properties
5. SYNTHESIS of SnI_4. REFLUX. (1 laboratory exercise)
The subject of this laboratory exercise is the synthesis of SnI_4. Utilization of a condenser for the first time. Different solvents in synthesis and their effect.
Yield calculation and recrystallization.
6. SYNTHESIS of $[CoCl_2(qui)_2]$. Qui = 8-hydroxyquinoline (2 laboratory exercises)
Use of reflux for the synthesis. Study of the equilibrium of tetrahedral-octahedral complex with electronic spectroscopy.. Solid state and solution. First contact with Orgel and Tanabe-Sugano charts.
7. SYNTHESIS OF GROUP 2 HYDRATED OXALATES. THERMAL ANALYSIS OF THE PRODUCTS. (3 laboratory exercises)
The aim of the laboratory exercise is the synthesis and characterization of the complexes M(ox).xH2O (M = Mg, Ca, Sr and ox = $C_2O_4^{2-}$) The influence of the size of the metal product on the properties of the complex Thermogravimetric analysis and thermal decomposition of complexes

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Laboratory</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>e-mail, Powerpoint, additional notes on tutors and/or demonstrator’s web pages</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>
<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>13</td></tr>
<tr><td>Laboratory Practice</td><td>52</td></tr>
<tr><td>Tutoring</td><td>13</td></tr>
<tr><td>Report preparation</td><td>24</td></tr>
<tr><td>Study</td><td>23</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td><i>125</i></td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>
<i>Language of evaluation, methods of</i></td><td>Assessment of the students is done through laboratory exercises, oral and / or short written examinations during the workshop and written examinations at the end of the semester.
Reports include the basic theoretical purpose of the</td></tr>
</table>

evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	exercises, the experimental part and the analysis-interpretation of the results. Final exams include: Short answer, judjment, development and problem solving questions All the above evaluation criteria are explained to the students at the beginning of the workshop.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Κεσίσογλου Δημήτρης, Ακρίβος Περικλής, Ασλανίδης Παρασκευάς, Καραφίλογλου Παντελής, Δενδρινού - Σαμαρά Αικατερίνη, «Βιοσυναρμοστική χημεία, Τόμος 2: Σύνθεση και Μελέτη Ενώσεων Συναρμογής, Εκδόσεις Ζήτη, Θεσ/νικη 2006.
2. Ακρίβος Περικλής Δ., Ασλανίδης Παρασκευάς, Καραγιαννίδης Πέτρος, «Σύνθεση και μελέτη σύμπλοκων ενώσεων, Εκδόσεις Ζήτη, Θεσ/νικη 1999.

OTHER

1. K. Nakamoto, "Infrared and Raman Spectra of Inorganic and Coordination Compounds, 5th edition, Parts A and B", Willey-Interscience Pubs, 1997.
2. Butler, Harrod, «Inorganic Chemistry. Principles and Applications», (in Greek), Κωσταράκη, 1994
3. A.B.P. Lever, "Inorganic electronic spectroscopy (second edition), Elsevier, 1984
4. Zvi Szafran, Ronald M. Pike, Mono M. Singh, "Microscale Inorganic Chemistry", J. Wiley (1991).
5. http://orgchem.colorado.edu/hndbksupport/irtutor/tutorial.html
6. http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/Spectrpy/InfraRed/infrared.htm
7. http://riodb01.ibase.aist.go.jp/sdbs/cgi-bin/direct_frame_top.cgi
8. http://symmetry.otterbein.edu/tutorial/index.html
9. http://chemistry.bd.psu.edu/jircitano/TSdiagram.pdf

-- Related academic journals:

Inorganic Chemistry
European Journal of Inorganic Chemistry
Journal of Chemical education
Polyhedron
Inorganic Synthesis

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHY 028**	**SEMESTER**	**3**
COURSE TITLE	**Organic Chemistry II**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Laboratory Experiments	0	0
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised General Knowledge/Skills Development
PREREQUISITE COURSES:	For a better understanding of this course basic knowledge of Organic Chemistry is required, such as the course Organic Chemistry I
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek All curriculum has been filmed and offered to the interested students as Online Service of the University of Ioannina at the link: E-Course / Asynchronous Tele-Education System
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=991

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Knowledge

- Understanding basic concepts of organic chemistry, physical and chemical properties of certain classes of organic compounds in relation to functional groups and their general structure
- Understanding the relationship of structure and chemical behavior of specific classes of organic compounds
- Understanding specific mechanisms of organic reactions

Skills

- Enlargement of the scientific horizon, better understanding of matter and deepening.

- The application of concepts, reactions and mechanisms to simple or complex associations and the logical handling of synthetic problems

Abilities

- Ability to apply his knowledge in dealing with synthetic problems of organic chemistry.
- Ability to approach synthetic problems and to suggest the most appropriate synthetic course of a composition.
- Ability to investigate international bibliography and gather information to solve complex synthetic problems.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competences that the student should have acquired and to which the course is aimed are:
- Theoretical training and acquisition of skills for approaching multidisciplinary issues and problems.
- Ability to search scientific information from international literature, understanding and presentation.
- Teamwork and work in an international interdisciplinary environment.

(3) SYLLABUS

The course Organic Chemistry II refers to important classes of organic compounds (amines, phenols, carbonyl compounds, aromatic and heterocyclic compounds, see contents). Their physical and chemical properties are studied, their composition, the mechanisms of the various transformations and their general significance, such as their connection with life and biological processes, as bioactive molecules occurring in nature.
The lesson consists of the following individual subject areas:

1. Benzene and aromaticy

Thematic unit description: Nomenclature of aromatic compounds, structure and stability of benzene, description of this on the basis of coordination and molecular orbitals, Hückel rule, aromatic ions, heterocyclic and polycyclic aromatic compounds.

Keywords: Aromaticity, aromatic compounds.

2. Chemistry of benzene

Thematic unit description: Electrophilic aromatic substitution mechanism (chlorination, bromination, alkylation and Friedel-Crafts acylation), interpretation of the effect of substituents on aromatic rings, polyunsaturated benzenes and additive phenomena of the groups. Nuclear aromatic substitution - mechanisms (addition / elimination, elimination / addition), benzyne.

Key words: Electronophilic and nucleophilic reagent, aromatic substitution, elimination, addition.

3. Aliphatic amines

Thematic unit description: Nomenclature, structure and amine stereochemistry, physical and chemical properties of amines - basicity, synthesis and reaction of amines.

Key words: Basicity, elimination, rearrangement.

4. Arylamines and phenols

Thematic unit description: Properties of arylamines-basicity, preparations and their reactions, properties of phenols – acidity, preparations and reactions of phenols.

Key words: Acidity, electrophilic aromatic substitution, mechanism.

5. Heterocyclic compounds

Thematic unit description: Heterocyclic compounds with five-membered and six-membered ring-nomenclature, condensed ring heterocyclic compounds, electrophilic and nucleophilic substitution reactions.

Key words: Aromaticity, heterocyclic aromatic rings.

6. Aldehydes and ketones

Thematic unit description: Nomenclature, structure, synthesis, physical and chemical properties of aldehydes and ketones.

Key words: Nucleophilic reagent-nucleophilic addition, acidity H in α-position, enol, enol ions, tautomerism, condensation, isomerism.

7. Aldehydes and ketones - nucleophilic addition

Thematic unit description: Nucleophilic addition to the carbonyl of aldehydes and ketones-mechanism.

Key words: Nucleophilic reagent-nucleophilic addition, acidity H in α-position, enol, enol ions, tautomerism, condensation, isomerism.

8. Aldehydes and ketones - α-position acidity and condensations

Thematic unit description: Acity of H in α-position to C = O, explanation, consequences, enol anions. Enol-ketone tautomerism, reactions (alkylation, halogenation, acylation, aldol condensation, etc.), isomerism, α,β–unsaturated carbonyl compounds, reactions thereof.

Key words: Nucleophilic reagent-nucleophilic addition, acidity H in α-position, enol, enol ions, tautomerism, condensation, isomerism.

9. Carboxylic acids

Thematic unit description: Nomenclature, structure, synthesis, properties of carboxylic acids, their acidity - effect of substituents - comparison with other acidic organic compounds, reactions - comparison with aldehydes and ketones.

Key words: Acidity of carboxylic acids.

10. Carboxylic acid derivatives

Thematic unit description: Acid derivatives: halides, anhydrides, esters, amides and nitriles, nomenclature, physical and chemical properties, synthesis of derivatives, relative activity, nucleophilic substitution reactions, mechanisms.

Key words: Reactivity, nucleophilic acyl-substitution, derivative transformations, α-position acidity, condensations, mechanisms, syntheses.

11. Carboxylic acid derivatives - α-position acidity, concentrations

Thematic unit description: α-position acidity of carboxylic acid derivatives, Claisen and Dieckmann condensations, Michael reaction, malonate synthesis and ethyl acetoacetate synthesis.

Key words: Reactivity, nucleophilic acyl-substitution, derivative transformations, α-position acidity, condensations, mechanisms, syntheses.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>e-Electronic communication with students.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>
<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures-Suggestions</td><td>50</td></tr>
<tr><td>Individual study, preparation</td><td>50</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>100</td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>
<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>
<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>The evaluation of the students is done by written final examination (evaluation) in Greek which includes:
I. Written / oral final examination including:
o the development of topics
o short answer questions
o answers to crisis questions problem solving</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Organic Chemistry, David R. Klein, UTOPIA Εκδόσεις ΕΠΕ

2. Organic Chemistry volume B΄, VOLLHARDT PETER, SCHORE NEIL
   (translation Spyroudis Spyros, Rodios Nestor, Malamidou-Xenikaki Elisavet),
   Publishing Company Kyriakidis Bros.
3. Organic Chemistry John McMurry
4. L.G. Wade
5. Organic Chemistry, R.T. Morisson και R.N. Boyd,
6. Organic Chemistry, A. Streitwieser and C-H. Heathcock

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	XHY 033	**SEMESTER**	3rd
COURSE TITLE	PHYSICAL CHEMISTRY II		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures		4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	The Department's curriculum does not require any prerequisite courses. However, the essential attendance and participation in the course lectures presupposes the assimilation of basic mathematical and thermodynamics coursework knowledge taught in the first year of studies (Calculus I & II and Physical Chemistry I) of the Chemistry Department.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)	http://users.uoi.gr/melissas/notes/lecture%20notes.htm		

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*

- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*

- *Guidelines for writing Learning Outcomes*

The Physical Chemistry II compulsory course aims to introduce students in the concepts of chemical kinetics and quantum mechanics.

The course material aims at introducing students to the following subjects:
-perception of the importance of time in chemical reactions,
-writing equations describing the time evolution of a chemical reaction,
-the proposal of chemical reaction mechanisms compatible with experimental data,
-understanding parameters affecting chemical reactions rates,
-the embedding of the wave-particle duality of light and matter,
-familiarization with Schrödinger equation and its statistical interpretation,
-the emergence of the uncertainty principle in the physical properties assessment,
-the utilization of square potential wells in the interpretation of chemical reactions,
-the necessity of the harmonic oscillator approach and
-the completeness of the hydrogen atom eigenstates.

After successful completion of the course, students should be able to:
-realize the evolution of time in chemical and physical phenomena,
-write correctly equations describing the time evolution of a chemical system,
-propose chemical reaction mechanisms compatible with experimental data,
-understand parameters affecting chemical reactions rates,
-accept the duality of wave and particle-like nature for particles and electromagnetic radiation,
-establish and solve Schrödinger equation for a series of problems,
-easily use operators' tools for physical properties visualization purposes,
-clearly describe simple particle problems in square potential wells,
-easily handle the harmonic oscillator approach and
-solve for the eigenstates of hydrogen atom.

Knowledge of:
-to acquire knowledge on basic concepts and theories of chemical kinetics,
-basic knowledge of reaction mechanisms and their correlation with chemical kinetics,
-assimilation of the wavelength-particle duality for radiation and matter,
-complete knowledge of the prerequisite mathematical background, which includes manipulation of operators, solving partial differential equations, introductory concepts of statistics, solving definite integrals,
-application of the Schrödinger equation in discrete and continuous eigenvalue potential wells,
-in-depth knowledge of the harmonic oscillator application in a variety of problems and
-thorough and detailed knowledge of the complete hydrogen atom problem.

Skills:

-in applying basic concepts and theories of chemical kinetics,

-in identifying reaction mechanisms and matching their correlation with chemical kinetics,

-in assimilating the wavelength-particle duality for radiation and matter,

-in acquiring the prerequisite mathematical background, which includes manipulation of operators, solving partial differential equations, introductory concepts of statistics, solving definite integrals,

-in applying the Schrödinger equation in discrete and continuous eigenvalue potential wells,

-in applying the harmonic oscillator approximation in a variety of problems and

-in solving the complete hydrogen atom problem.

Abilities:

-to understand basic concepts and theories of chemical kinetics,

-to apply reaction mechanisms and denote their correlation with chemical kinetics,

-to assimilate the wavelength-particle duality for radiation and matter,

-to acquire the prerequisite mathematical background, which includes manipulation of operators, solving partial differential equations, introductory concepts of statistics, solving definite integrals,

-to apply the Schrödinger equation in discrete and continuous eigenvalue potential wells,

-to practice the harmonic oscillator application in a variety of problems and

-to solve the hydrogen atom problem.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

……

Others…

…….

The course aims at acquiring basic knowledge of physical chemistry, necessary for the understanding of the wider field of chemical science. It also aims at developing critical thinking, which is tragically absent amongst high school graduates.

In particular, the areas of focus and understanding of the above concepts are aimed at developing the following basic abilities:
-discarding the image of classical particles for leptons and hadrons and adopting the correct quantum-mechanical image of the "material wave",
-revaluating the offered mathematical "tools" and thorough understanding of their application,
-recognizing the origin of the Schrödinger equation and its applicability to all queries regarding a particle’s life,
-identifying the restrictive terms of each particle and exploiting their definition,
-enhancing cooperation between students to realize the physical chemistry concepts and figure out how to deal with them,
-seeking complementary solutions and applying critical thinking in the choice of available "tools" and
-designing and managing a thorough number of problems to gain self-confidence and self-reliance about the "new" way of thinking.

(3) SYLLABUS

-Chemical reactions rates: experimental rate law.
-Reaction rates and rate laws.
-Effect of temperature and Arrhenius equation.
-Determination of the reaction mechanism through the reaction rate law.
-I: Elementary reactions. Consecutive reactions. Parallel reactions. Steady state approximation in chemical kinetics. Mechanisms and the rate determining step.
-II: Reactions approaching equilibrium. Homogeneous catalysis, enzymatic kinetics.
-Complex reactions: explosions. Photochemical reactions.

-The wave-particle dualism of light and matter.
-Schrödinger equation and its statistical interpretation.
-The uncertainty principle.
-Potential wells I: discrete/quantized solutions.
-Potential wells II: continuous energies.
-The harmonic oscillator.
-Hydrogen atom I: spherically symmetric solutions.
-Hydrogen atom II: solutions with angular dependence (angular momentum).
-Atom in a magnetic field and the emergence of spin.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>In class lecturing, encouraging students to participate with comments and questions.
A significant part of the course is being taught within the “Physical Chemistry Lab II” framework.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support of the learning process through the e-course platform, a variety of short explanatory video projections and the use of specialized web pages.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>
<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Series of problems focusing on the application of methodologies and the enhancement of cooperation between students</td><td>32</td></tr>
<tr><td>Interactive teaching</td><td>10</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Independent Study</td><td>31</td></tr>
<tr><td>Course total</td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>
<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>
<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Chemical Kinetics: Students are required to either participate in two midterm exams or a final exam. Exams mainly focus on problem solving.
Quantum mechanics: Two choices are offered:
a) three quick exams (~20 minutes each) without any prior notification (50 % of the grade), the one with the lowest grade is being rejected, and a final quick exam at the end of the semester (25 % of the grade). 10 homework sets gain an extra 25 % of the final grade.
b) a final three-hour exam at the end of the semester.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

ΚΒΑΝΤΟΜΗΧΑΝΙΚΗ ΤΟΜΟΣ Ι QUANTUM MECHANICS I	ΤΡΑΧΑΝΑΣ ΣΤΕΦΑΝΟΣ STEFANOS TRACHANAS	ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ CRETAN UNIVERSITY PRESS
ΚΒΑΝΤΟΜΗΧΑΝΙΚΗ ΤΟΜΟΣ ΙΙ QUANTUM MECHANICS II	ΤΡΑΧΑΝΑΣ ΣΤΕΦΑΝΟΣ STEFANOS TRACHANAS	ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ CRETAN UNIVERSITY PRESS
Ο ΧΗΜΙΚΟΣ ΔΕΣΜΟΣ THE CHEMICAL BOND	MURELL J.N., KETTLE S.A., TEDDER J.N.	ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ CRETAN UNIVERSITY PRESS

ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΚΒΑΝΤΙΚΗ ΧΗΜΕΙΑ INTRODUCTION TO QUANTUM CHEMISTRY	ΤΣΙΠΗΣ ΚΩΝ/ΝΟΣ CONSTANTINOS TSIPIS	ΖΗΤΗ ΠΕΛΑΓΙΑ ΚΑΙ ΣΙΑ Ο.Ε. ZITI PELAGIA LTD
ΜΟΡΙΑΚΗ ΚΒΑΝΤΙΚΗ ΜΗΧΑΝΙΚΗ MOLECULAR QUANTUM MECHANICS	ATKINS PETER WILLIAM	ΕΚΔΟΣΕΙΣ ΠΑΠΑΖΗΣΗ PAPAZISIS PRESS

-Συναφή επιστημονικά περιοδικά:

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHY 047**	**SEMESTER**	**3**
COURSE TITLE	PHYSICAL CHEMISTRY LABORATORY I		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	GENERAL BACKGROUND
PREREQUISITE COURSES:	There are not prerequisite courses in the Chemistry Department
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	Video tutorials and presentations can be found in http://ecourse.uoi.gr/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successful completion of the course, students should be able to**:**

-Understand physicochemical processes related to Chemical Thermodynamics
-Carry out a physicochemical determination experiment.
-Prepare a work in which physicochemical calculations are performed on the experimental results and diagrams from which the desired physicochemical quantities are determined
-Improve the presentations of projects

Knowledge

-Knowledge and understanding of the basic concepts, principles and theories related to the physicochemical field of Chemical Thermodynamics.
-Knowledge of the use of physicochemical data from the international literature.

Skills

-Skills to perform a demanding experiment with precision.
-Use of appropriate mathematical and computational techniques to solve complex physicochemical problems.
-Complex problem-solving skills through data analysis of international literature.

Abilities
-Ability to apply his / her knowledge in dealing with problems related to physical chemistry issues and especially Chemical Thermodynamics.
-Ability to perform complex calculations and identify different physicochemical parameters.
-Develop critical competence through the interpretation of the result.
-Ability to interact with other students or researchers in Chemical Thermodynamics.
-Ability to select and apply the most appropriate physicochemical methods and relevant methodology to solve a specific research problem.
-Ability to work in a team.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

-Ability to convert the knowledge of theory into solving and finding experimental parameters.
- Ability to apply knowledge from related courses
-Ability to search, analyze data and information from international literature and use the necessary technologies related to the presentation of research results.
-Acquiring the appropriate practical knowledge to allow further education at postgraduate level.
-Working in an interdisciplinary environment.
-Ability to work together at team level to achieve these goals.

(3) SYLLABUS

-Introduction to the laboratory: Thermochemistry ,Computer software, safety in the laboratory.
-Determination of salt solution enthalpy
-Deferential Scanning Calorimetry: Phase diagram of Urea-hexadecane mixture
-Determination of combustion enthalpy of organic compounds.
-Evaporation Enthalpy of water
- Zesseoscopy: Determination of molecular weight of organic compound
- Partially miscible binary blends: Phase diagram
-Ternary blends: Phase diagram
- gass-liquid phase diagram of binary mixtures
-Determination of Partial molar volume in binary mixtures
-Determination of surface tension of solutions with the Du Nouy ring tensiometer
- X-ray determination of structure of crystal compounds

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of internet for search of values of physical chemistry parameters.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Laboratory practice</td><td>50</td></tr>
<tr><td>Post processing of experimental data and report</td><td>40</td></tr>
<tr><td>lectures</td><td>10</td></tr>
<tr><td>Individual work</td><td>10</td></tr>
</table></td></tr>
</table>

directed study according to the principles of the ECTS	Project (in some cases)	15
	Course total	***125***
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Evaluation will be by final oral or written examination, which will cover all the semester's work (50% of the final grade) and the laboratory reports during the course (50% of the final grade). The passing grade for the course is 50%,	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:
-Peter Atkins and Julio de Paula Physical Chemistry Oxford University Press
-Physical chemistry laboratory S. Skoulika and A Michaelides University of Ioannina
-Physical chemistry laboratory notes C. Vlahos, V. Melissas, T. Lazaridis and A. Tampaki University of Ioannina

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	XHY 033	**SEMESTER**	3rd
COURSE TITLE	PHYSICAL CHEMISTRY II		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures		4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	The Department's curriculum does not require any prerequisite courses. However, the essential attendance and participation in the course lectures presupposes the assimilation of basic mathematical and thermodynamics coursework knowledge taught in the first year of studies (Calculus I & II and Physical Chemistry I) of the Chemistry Department.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEBSITE (URL)	http://users.uoi.gr/melissas/notes/lecture%20notes.htm		

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The Physical Chemistry II compulsory course aims to introduce students in the concepts of chemical kinetics and quantum mechanics.

The course material aims at introducing students to the following subjects:
-perception of the importance of time in chemical reactions,
-writing equations describing the time evolution of a chemical reaction,
-the proposal of chemical reaction mechanisms compatible with experimental data,
-understanding parameters affecting chemical reactions rates,
-the embedding of the wave-particle duality of light and matter,
-familiarization with Schrödinger equation and its statistical interpretation,
-the emergence of the uncertainty principle in the physical properties assessment,
-the utilization of square potential wells in the interpretation of chemical reactions,
-the necessity of the harmonic oscillator approach and
-the completeness of the hydrogen atom eigenstates.

After successful completion of the course, students should be able to:
-realize the evolution of time in chemical and physical phenomena,
-write correctly equations describing the time evolution of a chemical system,
-propose chemical reaction mechanisms compatible with experimental data,
-understand parameters affecting chemical reactions rates,
-accept the duality of wave and particle-like nature for particles and electromagnetic radiation,
-establish and solve Schrödinger equation for a series of problems,
-easily use operators' tools for physical properties visualization purposes,
-clearly describe simple particle problems in square potential wells,
-easily handle the harmonic oscillator approach and
-solve for the eigenstates of hydrogen atom.

Knowledge of:
-to acquire knowledge on basic concepts and theories of chemical kinetics,
-basic knowledge of reaction mechanisms and their correlation with chemical kinetics,
-assimilation of the wavelength-particle duality for radiation and matter,
-complete knowledge of the prerequisite mathematical background, which includes manipulation of operators, solving partial differential equations, introductory concepts of statistics, solving definite integrals,
-application of the Schrödinger equation in discrete and continuous eigenvalue potential wells,
-in-depth knowledge of the harmonic oscillator application in a variety of problems and
-thorough and detailed knowledge of the complete hydrogen atom problem.

Skills:

-in applying basic concepts and theories of chemical kinetics,

-in identifying reaction mechanisms and matching their correlation with chemical kinetics,

-in assimilating the wavelength-particle duality for radiation and matter,

-in acquiring the prerequisite mathematical background, which includes manipulation of operators, solving partial differential equations, introductory concepts of statistics, solving definite integrals,

-in applying the Schrödinger equation in discrete and continuous eigenvalue potential wells,

-in applying the harmonic oscillator approximation in a variety of problems and

-in solving the complete hydrogen atom problem.

Abilities:

-to understand basic concepts and theories of chemical kinetics,

-to apply reaction mechanisms and denote their correlation with chemical kinetics,

-to assimilate the wavelength-particle duality for radiation and matter,

-to acquire the prerequisite mathematical background, which includes manipulation of operators, solving partial differential equations, introductory concepts of statistics, solving definite integrals,

-to apply the Schrödinger equation in discrete and continuous eigenvalue potential wells,

-to practice the harmonic oscillator application in a variety of problems and

-to solve the hydrogen atom problem.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

……

Others…

…….

The course aims at acquiring basic knowledge of physical chemistry, necessary for the understanding of the wider field of chemical science. It also aims at developing critical thinking, which is tragically absent amongst high school graduates.

In particular, the areas of focus and understanding of the above concepts are aimed at developing the following basic abilities:

-discarding the image of classical particles for leptons and hadrons and adopting the correct quantum-mechanical image of the "material wave",

-revaluating the offered mathematical "tools" and thorough understanding of their application,

-recognizing the origin of the Schrödinger equation and its applicability to all queries regarding a particle’s life,

-identifying the restrictive terms of each particle and exploiting their definition,

-enhancing cooperation between students to realize the physical chemistry concepts and figure out how to deal with them,

-seeking complementary solutions and applying critical thinking in the choice of available "tools" and

-designing and managing a thorough number of problems to gain self-confidence and self-reliance about the "new" way of thinking.

(3) SYLLABUS

-Chemical reactions rates: experimental rate law.
-Reaction rates and rate laws.
-Effect of temperature and Arrhenius equation.
-Determination of the reaction mechanism through the reaction rate law.
-I: Elementary reactions. Consecutive reactions. Parallel reactions. Steady state approximation in chemical kinetics. Mechanisms and the rate determining step.
-II: Reactions approaching equilibrium. Homogeneous catalysis, enzymatic kinetics.
-Complex reactions: explosions. Photochemical reactions.

-The wave-particle dualism of light and matter.
-Schrödinger equation and its statistical interpretation.
-The uncertainty principle.
-Potential wells I: discrete/quantized solutions.
-Potential wells II: continuous energies.
-The harmonic oscillator.
-Hydrogen atom I: spherically symmetric solutions.
-Hydrogen atom II: solutions with angular dependence (angular momentum).
-Atom in a magnetic field and the emergence of spin.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In class lecturing, encouraging students to participate with comments and questions. A significant part of the course is being taught within the “Physical Chemistry Lab II” framework.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Support of the learning process through the e-course platform, a variety of short explanatory video projections and the use of specialized web pages.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Chemical Kinetics: Students are required to either participate in two midterm exams or a final exam. Exams mainly focus on problem solving. Quantum mechanics: Two choices are offered: a) three quick exams (~20 minutes each) without any prior notification (50 % of the grade), the one with the lowest grade is being rejected, and a final quick exam at the end of the semester (25 % of the grade). 10 homework sets gain an extra 25 % of the final grade. b) a final three-hour exam at the end of the semester.

Activity	*Semester workload*
Lectures	52
Series of problems focusing on the application of methodologies and the enhancement of cooperation between students	32
Interactive teaching	10
Independent Study	31
Course total	***125***

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

ΚΒΑΝΤΟΜΗΧΑΝΙΚΗ ΤΟΜΟΣ Ι QUANTUM MECHANICS I	ΤΡΑΧΑΝΑΣ ΣΤΕΦΑΝΟΣ STEFANOS TRACHANAS	ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ CRETAN UNIVERSITY PRESS
ΚΒΑΝΤΟΜΗΧΑΝΙΚΗ ΤΟΜΟΣ ΙΙ QUANTUM MECHANICS II	ΤΡΑΧΑΝΑΣ ΣΤΕΦΑΝΟΣ STEFANOS TRACHANAS	ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ CRETAN UNIVERSITY PRESS
Ο ΧΗΜΙΚΟΣ ΔΕΣΜΟΣ THE CHEMICAL BOND	MURELL J.N., KETTLE S.A., TEDDER J.N.	ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ CRETAN UNIVERSITY PRESS

ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΚΒΑΝΤΙΚΗ ΧΗΜΕΙΑ INTRODUCTION TO QUANTUM CHEMISTRY	ΤΣΙΠΗΣ ΚΩΝ/ΝΟΣ CONSTANTINOS TSIPIS	ΖΗΤΗ ΠΕΛΑΓΙΑ ΚΑΙ ΣΙΑ Ο.Ε. ZITI PELAGIA LTD
ΜΟΡΙΑΚΗ ΚΒΑΝΤΙΚΗ ΜΗΧΑΝΙΚΗ MOLECULAR QUANTUM MECHANICS	ATKINS PETER WILLIAM	ΕΚΔΟΣΕΙΣ ΠΑΠΑΖΗΣΗ PAPAZISIS PRESS

-Συναφή επιστημονικά περιοδικά:

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHY 301 (3.1)**	**SEMESTER**	**3rd**
COURSE TITLE	**Analytical Chemistry III**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background
PREREQUISITE COURSES:	No. According to the curriculum of the Department of Chemistry there are no prerequisites, but its attendance is not effective without the required knowledge of the courses of Analytical Chemistry I and Analytical Chemistry II
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on instrumental analytical chemistry, Electroanalytical Techniques, Potentiometry, Coulometry, Electrogravimetric Analysis, Polarography, Voltammetry, Introduction to Biosensors, Introduction to Spectrochemical Methods, Instrumentation for Optical Spectrometry, Molecular Absorption Spectrometry, Molecular Fluorescence Spectroscopy, Atomic Spectroscopy, Analytical Separations, Gas Chromatography, High-Performance Liquid Chromatography

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……

Production of new research ideas	*Others…* *…….*

Search, analysis and synthesis of data and information, by using the proper technologies. Working independently Team work Respect of natural environment Promoting free, creative and inductive thinking Understanding analytical science, demonstrate a coherent understanding of instrumental analytical chemistry Depth and breadth of analytical chemistry knowledge Inquiry and problem solving, critically analyse and solve problems in instrumental analytical chemistry Personal and professional responsibility, be accountable for individual learning and scientific work in (instrumental) analytical chemistry

(3) SYLLABUS

Introduction to instrumental Analysis. Electroanalytical Techniques. Potentiometry. Coulometry. Electrogravimetric Analysis. Polarography. Voltammetry. Introduction to Biosensors. Introduction to Spectrochemical Methods. Instrumentation for Optical Spectrometry. Molecular Absorption Spectrometry. Molecular Fluorescence Spectroscopy. Atomic Spectroscopy. Introduction to Analytical Separations. Gas Chromatography. High-Performance Liquid Chromatography.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see workload table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination in Greek, with multiple choice questionnaires and short-answer questions.

Activity	***Semester workload***
Lectures	52
Not guided study	30
Homework and preparation	43
Course total	125

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ΑΡΧΕΣ ΑΝΑΛΥΤΙΚΗΣ ΧΗΜΕΙΑΣ	SKOOG	ΚΩΣΤΑΡΑΚΗΣ Α.Ε.
ΕΝΟΡΓΑΝΗ ΑΝΑΛΥΣΗ	Θ. ΧΑΤΖΗΪΩΑΝΝΟΥ, Μ. ΚΟΥΠΠΑΡΗΣ	ΕΛΕΝΗ ΧΑΤΖΗΪΩΑΝΝΟΥ
ΑΡΧΕΣ ΕΝΟΡΓΑΝΗΣ ΑΝΑΛΥΣΗΣ	SKOOG	ΚΩΣΤΑΡΑΚΗΣ Α.Ε.

-Related Scientific Journals:
Journal of Chemical Education
Analytical Chemistry
Analytica Chimica Acta
Talanta

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE 503**	**SEMESTER**	**3**
COURSE TITLE	**Environmental Chemistry**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
LECTURES	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on Environmental chemistry, will be introduced to the principles and factual basis of chemistry in an environmental context, will gain an appreciation of the scientific methodology in environmental chemistry, and will develop problem-solving and critical-thinking skills that are necessary to analyse and discuss chemical and physical phenomena in the environment.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

This Course aims to promote:

- free, creative and inductive thinking
- understanding science, demonstrate a coherent understanding of environmental science
- scientific knowledge, exhibit depth and breadth of environmental science knowledge
- inquiry and problem solving, critically analyse and solve problems in environmental science
- communication, be an effective communicator of environmental science
- personal and professional responsibility, be accountable for individual learning and scientific work in environmental science

(3) SYLLABUS

Introduction to Environmental Chemistry, Chemistry Fundamentals (Chemical Equilibrium, Acid-Base Reactions, Redox Processes, Complexes and Complex Formation, Chemical Kinetics, Photochemical Processes, Radiochemistry), The Chemistry of Natural Environmental Processes, The Chemistry of Processes in the Atmosphere, The Chemistry of Processes in the Lithosphere, The Chemistry of Processes in the Hydrosphere, Natural Biochemical Processes and Organisms in the Biosphere, Effects of Pollutants on the Chemistry of the Atmosphere, Hydrosphere, and Lithosphere, Effects of Pollutants on the Biosphere: Biodegradability, Toxicity, and Risks, Physicochemical and Physical Treatment of Pollutants and Wastes, Biological Treatment of Pollutants and Wastes, The Minimization and Prevention of Pollution; Green Chemistry.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination,*	Written examination with multiple choice questionnaires and short-answer questions and essay/report (100%) in Greek.

Activity	***Semester workload***
Lectures	52
Study and analysis of bibliography	30
Not guided study	43
Course total	125

public presentation, laboratory work, clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1) Environmental Chemistry Fundamentals. J.G. Ibanez, M. Hemandez-Esparza, C. Doria-Serrano, A. Fregoso-Infante, M. Mohan Singh, Springer Science-Business Med ia, LLC (2007).
2) Principles of Environmental Chemistry, R. M. Harrison, RSC Publishing, 2007
3) An Introduction to Environmental Chemistry 2nd Edition, J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid, Blackwell Publishing, 2004
4) Environmental Chemistry, S. E. Manahan, 7th Edition, Lweis Publishers, 2000

- Related academic journals:

1) Journal of Chemical Education (American Chemical Society)
2) Environmental Science and Technology (American Chemical Society)
3) The Science of the Total Environment (Elsevier)
4) Environmental Pollution (Elsevier)

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHY 302 (3.6)**	**SEMESTER**	**3rd**
COURSE TITLE	**Laboratory of Analytical Chemistry I**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	knowledge, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After the successful completion of this course, according to the Descriptors for Levels 6 of the European Qualifications Framework for Lifelong Learning, students should be able to:

- To understand of the basic principles of Analytical Chemistry and its applications.
- Knowledge and good apprehension of the basic principles, theory and concepts of chemical analysis and data treatment.
- Knowledge and good apprehension of the applications of analytical chemistry on the analysis of complex substrates.
- Knowledge on the combinational use of analytical techniques and methods
- Knowledge of the use and search of international research literature.

Skills

- Skills related to the correct treatment of the results and solving analytical problems
- Skills related to the determination of information of the matter composition.

Abilities

- Ability to apply the knowledge for the problems solving related to basic statistic treatment of the data and to analyze inorganic and organic compounds.
- Ability of recognizing and applying the basic steps of analytical chemistry (method selection, method validation, sampling, method calibration, sample preparation, analysis and conclusions)

- Ability to use the existing literature for the proper method selection and exploitation in relation to the available equipment and consumables of a chemistry Laboratory.
- Ability of interaction with other students or researchers for chemical analysis concepts.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Theoretical thinking and transformation ability of theory to practice
Ability of application of knowledge gained to solving problems related to Analytical Chemistry
Search, analysis and synthesis of data and information, by using the proper technologies.
Working independently
Team work
Theoretical and practical knowledge background to proceed to advanced educational levels such as Master of Science and Doctoral diploma.
Promoting free, creative and inductive thinking
Working in interdisciplinary environment

(3) SYLLABUS

Introduction to qualitative analysis, Qualitative analysis of cations, Qualitative analysis of anions, Analysis of solid samples, Introduction to quantitative chemical analysis and statistical analysis, acid-base titrations, redox titrations, complexation titrations, gravimetric analysis.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures to support learning difficulties.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures on theoretical aspects.</td><td>13</td></tr>
<tr><td>Laboratory exercise</td><td>52</td></tr>
<tr><td>Personal essay writing</td><td>40</td></tr>
<tr><td>Personal study-preparation</td><td>20</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i></td><td>- Written examination (50%) in Greek including:
1. Subjects elaboration
2. Short answer questions
3. .Answer to judgment questions
4. Solving problems
- Personal essay with all laboratory exercises (50%)</td></tr>
</table>

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ΧΗΜΙΚΗ ΙΣΟΡΡΟΠΙΑ ΚΑΙ ΑΝΟΡΓΑΝΗ ΠΟΙΟΤΙΚΗ ΗΜΙΜΙΚΡΟΑΝΑΛΥΣΗ	ΘΕΜΙΣΤΟΚΛΗΣ ΧΑΤΖΗΪΩΑΝΝΟΥ	ΕΛΕΝΗ ΧΑΤΖΗΪΩΑΝΝΟΥ
ΣΗΜΕΙΩΣΕΙΣ ΕΡΓΑΣΤΗΡΙΟΥ ΑΝΑΛΥΤΙΚΗΣ ΧΗΜΕΙΑΣ Ι	*Α. ΒΛΕΣΣΙΔΗΣ, Μ. ΠΡΟΔΡΟΜΙΔΗΣ, Β. ΣΑΚΚΑΣ, Κ. ΚΟΝΙΔΑΡΗ, Δ. ΓΚΙΩΚΑΣ, Κ. ΣΤΑΛΙΚΑΣ, Τ. ΑΛΜΠΑΝΗΣ*	*ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)*
ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΠΟΣΟΤΙΚΗ ΧΗΜΙΚΗ ΑΝΑΛΥΣΗ	Α. ΒΟΥΛΓΑΡΟΠΟΥΛΟΣ, Α. ΖΑΧΑΡΙΑΔΗΣ, Ι. ΣΤΡΑΤΗΣ	ΖΗΤΗ ΠΕΛΑΓΙΑ ΚΑΙ ΣΙΑ Ο.Ε.
ΣΗΜΕΙΩΣΕΙΣ ΕΡΓΑΣΤΗΡΙΟΥ ΑΝΑΛΥΤΙΚΗΣ ΧΗΜΕΙΑΣ Ι	*Α. ΒΛΕΣΣΙΔΗΣ, Μ. ΠΡΟΔΡΟΜΙΔΗΣ, Β. ΣΑΚΚΑΣ, Κ. ΚΟΝΙΔΑΡΗ, Δ. ΓΚΙΩΚΑΣ, Κ. ΣΤΑΛΙΚΑΣ, Τ. ΑΛΜΠΑΝΗΣ*	*ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)*
ΒΑΣΙΚΕΣ ΑΡΧΕΣ ΑΝΑΛΥΤΙΚΗΣ ΧΗΜΕΙΑΣ	ΘΕΜΕΛΗΣ ΔΗΜΗΤΡΙΟΣ	ΖΗΤΗ ΠΕΛΑΓΙΑ ΚΑΙ ΣΙΑ Ο.Ε.
ΣΗΜΕΙΩΣΕΙΣ ΕΡΓΑΣΤΗΡΙΟΥ ΑΝΑΛΥΤΙΚΗΣ ΧΗΜΕΙΑΣ Ι	*Α. ΒΛΕΣΣΙΔΗΣ, Μ. ΠΡΟΔΡΟΜΙΔΗΣ, Β. ΣΑΚΚΑΣ, Κ. ΚΟΝΙΔΑΡΗ, Δ. ΓΚΙΩΚΑΣ, Κ. ΣΤΑΛΙΚΑΣ, Τ. ΑΛΜΠΑΝΗΣ*	*ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)*

- Related academic books:

1. «ΠΟΙΟΤΙΚΗ ΑΝΑΛΥΣΙΣ ΚΑΙ ΧΗΜΙΚΗ ΙΣΟΡΡΟΠΙΑ», Θ.Π. Χατζηϊωάννου, Αθήναι, 1989
2. «ΧΗΜΙΚΗ ΙΣΟΡΡΟΠΙΑ ΚΑΙ ΑΝΟΡΓΑΝΗ ΠΟΙΟΤΙΚΗ ΗΜΙΜΙΚΡΟΑΝΑΛΥΣΗ», Θ.Π. Χατζηϊωάννου, 1993
3. «INTRODUCTION TO QUALITATIVE ANALYSIS», D.C. Layde and D.H. Busch, 2d Ed., Allyn and Bacon, Inc., Boston, 1968
4. «QUALITATIVE ANALYSIS AND THE PROPERTIES OF IONS IN AQUEOUS SOLUTIONS», E.J. Slowinski and W.L. Masterton, 2d Ed., Saunders College Publishing, N.Y., 1990
5. «VOGEL'S QUALITATIVE INORGANIC ANALYSIS», G. Svehla, 7th Ed., Longman, England, 1996
6. «CHEMICAL PRINCIPLES WITH QUALITATIVE ANALYSIS», W. L. Masterton, E. J. Slowinski, Saunders Company, N.Y., 1978
7. Fundamentals of Analytical Chemistry 9th Edition, Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Brooks/Cole (2014)
8. Quantitative Chemical Analysis, 9th Edition, Daniel C. Harris, Wiley (2015)

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHY 051**	**SEMESTER**	**4th**
COURSE TITLE	BIOCHEMISTRY I		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	4
Project preparation	1	1
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	*General background*
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/enrol/index.php?id=174

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will be able to:

- Describe basic concepts related to chemistry, biochemistry and properties of biomolecules
- Find the kinetic parameters of enzymes and solve related problems
- Know and describe the basic concepts of bioenergetics
- Describe the linked pathways of metabolism.
- Compare and contrast anabolism and catabolism.
- Describe how enzymes control metabolic reactions.
- Explain how metabolic pathways are regulated
- Explain how ATP stores chemical energy and makes it available to a cell
- Explain how the reactions of cellular respiration release chemical energy.
- Describe the general metabolic pathways of carbohydrate metabolism, pentose phosphate, citric citrate and glyoxylate cycles, oxidative phosphorylation linked with respiratory chain and the metabolism of fatty acids.
- Understand and describe the molecular level of health disorders associated with malfunctions in

metabolism

- Know and write the chemical reactions and mechanisms taking place in the above pathways.
- Describe the function of the regulatory enzymes involved in the above pathways
- Solve problems of data interpretation and calculation of biochemical parameters

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search, analysis and synthesis of data and information, by using the proper technologies.
- Autonomous work
- *Working in an interdisciplinary environment*
- Promoting free, creative and inductive thinking

(3) SYLLABUS

Introduction to Biochemistry and Molecular Biology. Biomolecules and their properties. Introduction to Cell Biology. Basic principles of Bioenergetics, Introduction to Metabolism. Anabolic and catabolic procedures. Energy conjugation. ATP as the "molecular unit of currency”. Electron carriers. Stages and general principles in intermediary metabolism. Biological catalysis. Enzymes: Terminology, kinetics, specificity, requirements, co-enzymes, co-factors. Principles of Metabolic Regulation. Carbohydrate metabolism: Glycolysis, gluconeogenesis, glycogenolysis, glycogenesis. Cori cycle. Pentose phosphate shunt. The Citric Acid Cycle. The Glyoxylate Cycle. Oxidative phosphorylation and respiratory chain. Photosynthesis. Calvin cycle. Fatty Acid catabolism and anabolism, beta oxidation.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY
Face-to-face, Distance learning, etc.

Face to face

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students

- Use of PowerPoint in lectures.
- Projection and analysis of scientific videos
- Communication with the students via email.

TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS

Activity	*Semester workload*
Lectures	**80**
Study and self preparation	**30**
Projects preparation and presentation	**15**
Course total	**125**

STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (90%) in Greek, with questions for analytical answers, multiple choice and short-answer questions. Optional written projects with public presentation (10%).

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ΒΙΟΧΗΜΕΙΑ	BERG J.M., TYMOCZKO J.L., STRYER L.	ITE-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ
LEHNINGER ΒΑΣΙΚΕΣ ΑΡΧΕΣ ΒΙΟΧΗΜΕΙΑΣ	NELSON DAVID L., COX MICHAEL M.	BROKEN HILL PUBLISHERS LTD

http://www.ncbi.nlm.nih.gov/pmc/
http://www.sciencedirect.com/
https://www.google.gr/

- Related academic journals:

1. Biochimica et Biophysica Acta
2. Nature Reviews
3. Journal of Biological Chemistry
4. Biochemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	CHEMISTRY DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHY 022**	**SEMESTER**	**2**
COURSE TITLE	INORGANIC CHEMISTRY II		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific Area / Special Background / Development Skills
PREREQUISITE COURSES:	NONE
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://users.uoi.gr/iplakatu/site/ARXIKH.htm http://users.uoi.gr/shadjika/Hadjikakou_1/Hadjikakou_08.htm

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, descriptive marker 6 of the European Qualifications Framework, students should be able to:

- Understand ways of interacting transition metals with ligands.
- Understand the role of coordination compounds in life and technology.
- Understand ligand exchange reactions.
- Understand the basic principles of bond theories and their application to Coordination Chemistry.
- Understand the relationship between bond theories and reactions involving metal complexes.
- Understand the spectroscopic and magnetic properties of coordination compounds.
- Understand the imperfections of some bond theories and choose the appropriate theory for use.
- The second part of the course covers the part of the matter of Inorganic Chemistry referring to the chemical elements of the main groups of the periodic table and their compounds. In this lesson, young chemists meet with to the most important new developments in inorganic chemistry. The presentation of the properties of the chemical elements and their compounds is done in a systematic manner according to the groups of the periodic table. The presentation method is comparative. Each chapter develops

both the normal and the unusual behaviour of certain elements. In the manufacturing processes, the main treatments necessary for the isolation of the elements are generally reported. Along with the reference to new methods of manufacturing certain elements and their compounds, they develop their most characteristic chemical properties as well as their most important applications in other fields of science and technology. Finally, the student has the notes in a modern way of presenting the chapters to be examined

Knowledge

- Knowledge and understanding of basic and advanced principles of coordination chemistry.
- Knowledge and understanding of all bond theories applied to complexes.
- Knowledge and understanding of the evolution of bond theories, and their imperfections.
- Knowledge and understanding of complex formation and substitution reactions.
- Knowledge and understanding of the relationships between structure and reactivity of the complexes
- Knowledge and understanding of spectroscopic and magnetic properties of coordination compounds.
- Knowledge of structure and properties of various compounds containing metals.
- Knowledge of the most important new developments in inorganic chemistry.
- Knowledge of the properties of the chemical elements and their compounds
- Knowledge of both the normal and unusual behaviour of certain elements.
- Knowledge of the manufacturing processes, the main treatments necessary to isolate the elements.

Skills

- Skills to solve problems related to coordination chemistry.
- Skills to solve problems related to structural coordination chemistry.
- Skills to solve problems related to the reactivity of complex compounds.
- Skills to solve problems associated with spectroscopy and magnetism in complexes.

Abilities

- Ability to apply their knowledge in addressing issues related to coordination chemistry.
- Ability to combine bibliographic / experimental data and provide for chemical reaction products containing complexes.
- Ability to interact with other students or researchers in the field of coordination chemistry and transition metals.
- Ability to select and apply relevant methodology for solving a particular spectroscopic and / or magnetochemical problems involving a metal center.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competencies that the student should have acquired and to which the course is aimed are:

- Theoretical thinking and ability to translate theory into practice.
- Ability to apply knowledge acquired during the study period and related courses of the curriculum of the Department of Chemistry.
- Ability to search, analyze and synthesize data and information from international literature and use the necessary technologies related to the presentation of research results.
- Acquiring the appropriate theoretical and practical knowledge base to allow further education at the postgraduate level of specialization and doctorate.
- Working in an interdisciplinary environment.

- Ability to work together at team level to achieve these goals.

(3) SYLLABUS

Nature and type of elements in the periodic table. Single, dual and polyatomic elements Extensive structures. Metals. Chemistry of the elements in relation to their position in the periodic table. Elements of 1st, 2nd period, master group elements, transition elements, f-elements. Hydrogen, hydrides, molecular and atomic hydrogen reactions, applications. Elements of the 1st group of the IP Binary compounds, hydroxides, salts. Inclusion associations. Organometallic salts and applications. Elements of the 2nd Group of the IP Binary compounds, hydroxides, salts. Integration associations. Organometallic salts and applications. Beryllium. Boron. Oxygen compounds, halides, hydrides, boron-nitrogen compounds. Al, Ga, In, Tl. Carbon. Graphite, diamond, fuller and carbide. Carbon oxides. Carbonic acid and oxyacids. Metallocarbonyls and organometallic compounds. Silicon. Comparison of C-Si. Silicones, silicones. Ge, Sn, Pb. Nitrogen. Nitrides, hydrides, oxides. Halogenated. Acids. Phosphorus. Oxides, oxy compounds. As, Sb, Bi. Oxygen. Properties, allotropic forms. Oxides, peroxides, superoxides. Complexation of O2. Molecular oxygen-breathing vectors. Sulfur. Properties, allotropic forms. Sulfides, polysulfides. Oxides, oxyacids. Se, Te, Po. Halogen. Halogenated. Oxides. Oxyacids. Noble gases. Properties. Foreign: compounds Zn, Cd, Hg. Transition metals). Theory of the Field of Substituters. Molecular orbits. Magnetic properties. Molecular orbits. Magnetic properties. Introduction to compounds with M-M bonds. Ti, Zr, Hf. V, biological role, Nb, Ta. Cr, peroxo-chromium compounds, Mo, W, biological role. Mn, Tc, Re. Fe, Co, Ni, biological role, applications. Cu, Ag, Au, biological role, applications. Platinum group metals. Ru, Os, Rh, Ir, Pd, Pt. Sc, Y, La, Lanthanides. Kiwi. Integration chemistry. Stochastic Theory, Crystalline Field Theory and Field Theory of Substituters. Structure of complexes. AE = 2, AE = 3, AE = 4. AE = 5, AE = 6. Distortions from ideal geometry. Greater coordination numbers. Chelation phenomenon. Methodology for classifying inclusion compounds.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Classroom</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>e-mail, Powerpoint</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures, tutoring</td><td>52</td></tr>
<tr><td>Study, preparation</td><td>73</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Student evaluation is made through progress exams during the course and written final examination (evaluation) in Greek which includes:
Theoretical questions
Multiple choice questions
Responses to questions of judgement
Problem solving.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

1. Basic inorganic chemistry, (in greek) F. Albert Cotton, Geoffery Wilkinson, Paul Gaus, ed. Parisianou, 2015
2. Advanced Inorganic Chemistry, F.A. Cotton, G. Wilkinson, C. A. Murillo, M. Bochmann, John Wiley and sons, 1999.
3. INORGANIC CHEMISTRY (IN GREEK), C. E. HOUSECROFT, A. G. SHARPE,
4. Inorganic Chemistry (in Greek), James E. Huheey, Harper Collins Eds., 3rd ed., 1983
5. Chemistry Principles, Nick Hadjiliadis

Related Journals
ACS: JACS, Inorganic Chemistry
RSC: Dalton Trans., Chem. Commun., New J. Chem, RSC Advances
Elsevier: Polyhedron, Inorg. Chim. Acta, Inorg. Chem. Commun.
Wiley: European Journal of Inorganic Chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHY 402 (4.4)**	**SEMESTER**	**4th**
COURSE TITLE	**Laboratory of Analytical Chemistry II**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on analytical chemistry and instrumental analysis

Knowledge

• Knowledge and correct understanding of the basic concepts, principles and theories related to chemical analysis by instrumental analytical techniques.

• Knowledge and understanding of the main parts of the laboratory instrumentation.

• Knowledge and understanding of the applications of electroanalytical, spectrometric and separating techniques in chemical analysis.

• Knowledge of the adoption of quality criteria for analytical techniques and methods.

• Knowledge of the use and search of international bibliography.

Skills

• Skills in selecting and using the appropriate analytical technique or combination of techniques to solve complex problems of analytical chemistry.

Abilities

• Ability to interact with other students or researchers in chemical analysis.

• Ability to work in a team but also in a self-contained way of working.

•Ability to analyze bibliographic sources and utilize the appropriate method based on the infrastructures and available reagents of a chemical laboratory.

- Ability to select and apply the most appropriate experimental conditions to solve a specific problem at the level of routine analysis as well as research level.
- Work opportunities in an international environment.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Working independently
Team work
Respect of natural environment
Promoting free, creative and inductive thinking
Understanding analytical science, demonstrate a coherent understanding of analytical chemistry
Depth and breadth of analytical chemistry knowledge
Inquiry and problem solving, critically analyse and solve problems in analytical chemistry
Personal and professional responsibility, be accountable for individual learning and scientific work in analytical chemistry

(3) SYLLABUS

Introduction to Instrumental Analysis. Flamephotometry. Molecular Fluorescence Spectroscopy. Kinetic Methods of Chemical Analysis. Electroanalytical Techniques: Polarography. Voltammetry. Anodic Stripping Voltametry. Potentiometry. Coulometry. Introduction to Spectrochemical Methods. Molecular Absorption Spectrometry. Atomic Spectroscopy. Introduction to Analytical Separations. Gas Chromatography. High-Performance Liquid Chromatography.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face in groups of 3-5 students</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>13</td></tr>
<tr><td>Laboratory practice</td><td>52</td></tr>
<tr><td>Individual report</td><td>40</td></tr>
<tr><td>Non directed study</td><td>20</td></tr>
<tr><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple</i></td><td>Student evaluation is done
A) by written and oral examination during the laboratory exercise concerning the degree of</td></tr>
</table>

choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	understanding and assimilation of the theoretical knowledge, the control of the laboratory performance and skill required to perform the experiments and includes: • short -answer questions • problem solving • analysis of individual samples • writing of individual report (Includes entry of experimental results, critical evaluation of results, etc.) The evaluation of the above results in the Laboratory Grade (LG) as the average of the individual laboratory exercises performed by the student during the semester. B) Written final examination including: • the development of topics • short answer questions • multiple choice questionnaires • Problem solving. So the Written Examination Grade (WEG) level resulted. The final grade of the course results as an average of LG and WEG.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΕΝΟΡΓΑΝΗΣ ΑΝΑΛΥΣΗΣ	*Μ. ΚΑΡΑΓΙΑΝΝΗΣ, Χ. ΝΑΝΟΣ, Κ. ΣΤΑΛΙΚΑΣ, Ι. ΦΙΑΜΕΓΚΟΣ, Α. ΦΛΩΡΟΥ*	*ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)*

Ενόργανη Ανάλυση. Θ.Π. Χατζηιωάννου, Μ.Α. Κουππάρης. Πανεπιστήμιο Αθηνών, Αθήνα 2000.
Αρχές της Ενόργανης Ανάλυσης. D.A. Skoog, F.J. Holler, T.A. Nieman. Μετάφραση στα Ελληνικά: Μ. Καραγιάννης, Κ. Ευσταθίου, Ν. Χανιωτάκης. Εκδόσεις Κωσταράκης, Αθήνα, 2002.
Διαχωριστικές Τεχνικές στην Ενόργανη Χημική Ανάλυση. Ι. Παπαδογιάννης, ΑΠΘ, Θεσσαλονίκη, 1992.
Modern Analytical Chemistry. Editor: D. Harvey, 1st edn, McGraw-Hill, USA, 2000.
Ενόργανες Τεχνικές Αναλύσεως. Κ. Η. Ευσταθίου, Θ.Π. Χατζηιωάννου, , Τόμος Α, Παν/μιο Αθηνών, Αθήνα 1992

- Related academic journals:
Journal of Chemical Education
Analytical Chemistry
Analytica Chimica Acta
Talanta

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Chemistry		
LEVEL OF STUDIES	Graduate		
COURSE CODE	**XHY 055**	**SEMESTER**	**4**
COURSE TITLE	Laboratory of Physical Chemistry II		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background
PREREQUISITE COURSES:	Introductory Laboratory of Chemistry
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A
- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After completion of this lab lesson, the students should be able to:
- Understand the physicochemical processes related to electrochemistry and kinetics and physicochemical properties of dilute polymeric solutions
- Get familiar and optimize the process of preparing a lab project, in which physicochemical calculations are done and diagrams are plotted in order to derive the specific physicochemical parameter
- Improve themselves in the presentations taking place during the lab lesson

Knowledge
- Knowledge and understanding of the basic principles and theories which are related with the fields of electrochemistry, kinetics and polymer physical chemistry.
- Knowledge and understanding of applied spectroscopic techniques, such as UV/Vis, polosimetry, conductance, viscosity measurement etc.
- Knowledge in utilization of spectroscopic data from international literature.

Skills

- Skills concerning the understanding and elaboration of UV-Vis spectra.
- Utilization of the proper spectroscopic method or combination in order to solve complex problems of physical chemistry.
- Complex skills of resolving problems through data analysis of international literature.

Capabilities

- Capability to implement the knowledge to solve problems, which belong to the fields of electrochemistry, kinetics and polymer physical chemistry.
- Capability to interpret the spectral data from one or more techniques and extract various physicochemical parameters.
- Capability to interact with colleagues or researchers in issues concerning electrochemistry, kinetics and polymer physical chemistry.
- Capability to choose and apply the most appropriate spectroscopic methods and related methodology for the resolution of a specific research problem.
- Capability in team work as well as an individual person.

Capabilities of working in an international professional envrironment.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general capabilities which should be obtained by the student are:

- Theoretical thinking and the ability to convert the knowledge of theory into calculation of experimental parameters.
- Ability to implement knowledge obtained during study into related lessons taught in the department.
- Ability to search, analyze and synthesize data and information from international literature and utilization of appropriate technologies related to the presentation of research results.
- Obtaining the appropriate practical background of knowledge in order to be able to follow lessons in postgraduate level.
- Work in multidisciplinary environment.
- Ability to collaborate as a team for managing the aforementioned goals.

(3) SYLLABUS

Introductory lesson for exersises. Ag electrode, dependence of electromotive force y ionic power. Redox potentials. Conductivity of electrolytes. Transport numbers. Kinetic study with optical spectroscopy, order of reactions. First order reaction, Hydrolysis of sugar. Kinetics of reaction between iodide and persulfate. Concentration dependence. Kinetics of ester hdrolysis. Measurement of viscosity of polymer solutions for molecular weight calculation. Measurement of surface tension of polymer solutions. Membrane melting point. Electrophoresis.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Theoretical introduction in auditorium and practical application in the lab</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Utilization of Handbook and Internet for finding physicochemical parameters – Teaching the project method</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lab lessons</td><td>40</td></tr>
<tr><td>Preparation of personal reports</td><td>28</td></tr>
<tr><td>Lectures</td><td>2</td></tr>
<tr><td>project</td><td>15</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total <i>(17 hours of work per credit unit)</i></td><td><i>85</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>The evaluation of students is done by combining:
I. Written/oral final exam (40%) which contains:
○ Problem development
○ Short response questions
○ Critical questions
○ Problem solving.
II. Preparation of personal reports for each la lesson and project presentation (60%)</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Notes of Laboratory of Physical Chemistry II	*M. KOSMAS*	*IOANNINA UNIVERSITY (NOTES)*
Notes of Electrochemistry and Chemical Kinetics Lab Exercises	*A. KALAMPOUNIAS, M. KOSMAS, Α. ΜΥΛΟΝΑ-KOSMA, D. TASIS, G. TSAPARLIS*	*IOANNINA UNIVERSITY (NOTES)*

- Related academic journals:

Journal of chemical education
Journal of physical chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHE 611**	**SEMESTER**	**8**
COURSE TITLE	FOOD BIOCHEMISTRY AND BIOTECHNOLOGY		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general knowledge, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, level 6 of the European Qualifications Frame work) students will be able to comprehend the basic principles of the biochemistry of raw foods, of food indigenous enzymes, of the use of enzymes in food technology, of activities of food indigenous microorganisms, of the use of microorganisms in food technology, health-related properties of food constituents, and of functional foods.

Moreover, they will be able to solve problems and exercises related to the subjects of the course, and to correlate activities of enzymes, microorganisms and bioactive compounds with properties and characteristics of foods.

They will be able to conduct a literature search using modern technologies.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology. Working independently. Criticism and self-criticism. Production of free, creative and inductive thinking.

(3) SYLLABUS

History of enzyme and microbial activities in foods. Biochemistry of raw foods. Food indigenous enzymes. Use of enzymes in food technology. Activities of food indigenous microorganisms. Use of microorganisms in food technology. Health-related properties of food constituents. Functional foods.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of power point in lectures. Use of ICT technologies in communication with students.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures, seminars, educational visits</td><td>26</td></tr>
<tr><td>Study and analysis of bibliography, essay writing</td><td>34</td></tr>
<tr><td>Not guided study</td><td>65</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>The language of evaluation is Greek. The total evaluation consists of a) written examination (65 %), with open-ended questions, short-answer questions and multiple choice questionnaires, and b) written work, public presentation (35 %).</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

FOOD BIOCHEMISTRY	VAFOPOULOU-MASTROGIANNAKI A.	Ziti Publishing, 2003
FOOD BIOTECHNOLOGY	ROUKAS T.	Giachoudis Publishing 2009
FOOD BIOCHEMISTRY AND BIOTECHNOLOGY	*ROUSSIS I.*	*UNIVERSITY OF IOANNINA (ΣΗΜΕΙΩΣΕΙΣ)*

- Related academic journals:
1. Journal of Food Biochemistry
2. Food Biotechnology
3. Journal of Functional Foods
4. Food Technology and Biotechnology

- Related books:
    1. Biochemistry of Foods. Escin Michael NA. Academic Press 2013.
    2. Food, Fermentation and Micro-organisms. Bamforth Charles W.Blackwell Publishing 2005
    3. Functional Foods. Chadwick , Ruth F. Springer 2003.

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHY 063**	**SEMESTER**	**5**
COURSE TITLE	FOOD CHEMISTRY		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background, specialised general knowledge
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, level 6 of the European Qualifications Frame work, students will be able to comprehend the basic principles of the chemistry of food constituents, of nutrition and effect of food constituents in human health, of the chemical composition of food, of food analysis with emphasis in the use of GC and HPLC in food analysis.
Moreover, they will be able to solve problems and exercises related to the subjects of the course, and to correlate chemical composition with food properties.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Production of free, creative and inductive thinking. Criticism and self-criticism.

(3) SYLLABUS

Introduction in the chemistry of foods. Chemistry of food constituents (proteins, lipids, carbohydrates, water and inorganic constituents, vitamins, enzymes, phenolics, acids, alcohols, colourants, flavour compounds, additives). Introduction in nutrition, effect of food constituents in human health. Chemical composition of foods (dairy products, cereals, fruits and vegetables, legumes, meat and meat products, eggs, oils and lipids, sweeteners, spices, alcoholic and non-alcoholic beverages, potable water). Food analysis with emphasis in the use of GC and HPLC in food analysis.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of power point in lectures. Use of ICT technologies in communication with students.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures, seminars, educational visits</td><td>52</td></tr>
<tr><td>Not guided study</td><td>73</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>The language of evaluation is Greek. The total evaluation consists of written examination, with open-ended questions, short-answer questions and multiple choice questionnaires, problem solving.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

FOOD CHEMISTRY	BELITZ HANS - DIETER, GROSCH WERNER, SCHIEBERLE PETER	TSIOLIS PUBLISHING
FOOD CHEMISTRY	BOSKOU D.	GARTAGANIS PUBLISHING
NUTRITION AND FOOD CHEMISTRY	GALANOPOULOU et al.	STAMOULI PUBLISHING
INTRODUCTION IN FOOD CHEMISTRY	*VOUDOURIS E., KONTOMINAS M.*	*UNIVERSITY OF IOANNINA*
FOOD ANALYSIS	*VOUDOURIS E., KONTOMINAS M.*	*UNIVERSITY OF IOANNINA*
FOOD CHEMISTRY AND ANALYSIS	*ROUSSIS I.*	*UNIVERSITY OF IOANNINA*

- Related academic journals:

-Συναφή επιστημονικά περιοδικά:
1. Food Chemistry
2. Food Research International
3. Journal of agricultural and Food Chemistry
4. Journal of Food composition and Analysis

-Συναφή βιβλία
1. Food Chemistry, Belitz H.-D., Grosch W., Schieberle P., Sprieger 1999.
2.Food: the chemistry of its components, Coultate T.P., Royal Society of Chemistry 2009.
3.Introductory Food Chemistry, Brady J. W., cornell University Press 2013.
4.Food Chemistry, Damodaran S., , Parkin K.L.,. Fennema O.R., CRC Press 2007.

5. Food Analysis, Nielsen S., Springer 2010.

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	XHY075	**SEMESTER**	5th
COURSE TITLE	Laboratory of Biochemistry		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific area, specialist background, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=990

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Learning objectives

The purpose of the course is to train students in biochemistry techniques in order to have the basic practical and theoretical background for understanding and conduct experiments of modern biochemistry and its fields of application.

In a general context Learning is:

•Cell development, measurement, selection, and microscopic observation as well techniques for homogenizing and separating subcellular organelles.

The isolation and characterization of various organisms as intermediates Metabolism of the major categories of biomolecules, including Carbohydrates, lipids, proteins and nucleic acids.

•The use of basic principles of Chemistry such as stoichiometry, photometry, oxidation, reduction, chromatography, kinetics, electrophoresis, centrifugation, extraction, precipitation etc

•the isolation of biomolecules, their purification and characterization

•Knowledge and understanding of the basic concepts, principles and theories of

Biochemistry

Skills

- Determination, analysis and detection of biomolecules
- Complex skills, data analysis and solution of complex problems (eg kinetics Enzymes)

Abilities

- Ability to apply the knowledge provided in troubleshooting and analysis related to Biochemistry.
- Capability of cell growth observation study and measurement.
- Study and experimental ability to detect induction and induction expression of the biomolecules in the cells.
- The ability to isolate, purify, measure the enzymatic activity and kinetic characteristics of enzymes.
- Capability of analyzing and determining lipids.
- Capacity to isolate and characterize genomic and plasmid DNA.
- Ability to work independently and to interact with others students on subjects of the course.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competencies that the student should have acquired and in which aims the lesson is:

- Ability to apply knowledge acquired in related courses of the program of the Department of Chemistry.
- Ability to search, analyze, compose data and information from the international bibliography, use of the necessary technologies and programs related to the presentation of research results.

Acquiring the appropriate theoretical and practical knowledge base to be further education at postgraduate and PhD level.

- Work in an interdisciplinary environment.
- Possible cooperation at group level to achieve these goals.

(3) SYLLABUS

Cultures of microorganisms and use of the microscope. Isolation and characterization of *Tetrahymena pyriformis* phospholipids (Lipids I & II). Growth curve of *E.coli* DH5a/pUC18 and isolation of plasmid DNA (DNA I & II). Isolation and purification of acid phosphatase from wheat germ. Kinetics of the enzyme acid phosphatase from wheat germ. Immobilized yeast - Glucose metabolism and pyruvate-acetaldehyde detection. Glutamine synthetase in the yeast *Schizosaccharomyces pombe*. Characterization, hydrolysis and oxidation of glycogen. Emulsions-Gelatins.

(4) TEACHING and LEARNING METHODS – EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Laboratory Exercise; Face to Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education,*	Posting additional notes, exercises etc. on the teachers' websites Use of PowerPoint in lectures.

<table>
<tr><td><i>communication with students</i></td><td>Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>
<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>13</td></tr>
<tr><td>Laboratory Excercise</td><td>60</td></tr>
<tr><td>Written assignment</td><td>52</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Student assessment includes:
1. Evaluation / graduation of individual work
Refers to each laboratory exercise (70%)
2. Written final exam including development Topics (30%)</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1) Πειραματική βιοχημεία: Clark J. M., Switzer R. L., Παπαδόπουλος Γ., Παπαδόπουλος Μ., Πανεπιστημιακές Εκδόσεις Κρήτης 1992

2) Εργαστηριακές σημειώσεις Βιοχημείας. Μέλη Δ.Ε.Π. & ΕΔΙΠ Βιοχημείας Πανεπιστημίου Ιωαννίνων

3) Βιοχημεία: Stryer L, Αλετράς , Α., Παπαδόπουλος Γ., Κούβελας , Η., Πανεπιστημιακές Εκδόσεις Κρήτης 1995-1997

4) Βασικές αρχές βιοχημείας: Lehninger A. L., Nelson D. L. (David Lee) 1942-, Cox , Michael M., Παπαβασιλείου , Α. Γ. 1961-, Σταματόπουλος Κ., υπό Χατζηδημητρίου , Α. Ν., Fischer, Edmond H. Αθήνα:Εκδόσεις Πασχαλίδη; Cyprus: Broken Hill 2011

5) Βασικές αρχές κυτταρικής βιολογίας : εισαγωγή στη μοριακή βιολογία του κυττάρου Alberts B. 1938, Ζιούδρου Χ., Σταματόπουλος Κ. Αθήνα : Π. Χ. Πασχαλίδης c2000

6) Εισαγωγή στη Βιοχημεία: Γεωργάτσος Ι.Γ. Θεσσαλονίκη : Γιαχούδη-Γιαπούλη c1993

7) Βιοχημεία: Karlson P. 1918-, Doenecke , Detlef, Koolman , Jan, Σέκερης , Κ. Ε., Φραγκούλης Εμμ. Γ., Σέκερη-Παταργιά, Κ.Ε. Αθήνα:Λίτσας c1998 8) Θέματα βιοχημείας: Καπούλας , Β. Μ. Αθήναι : [χ. ό] 1972.

- Related academic journals:

COURSE OUTLINE

(1) GENERAL

<table>
<tr><td>SCHOOL</td><td colspan="3">Physical Sciences</td></tr>
<tr><td>ACADEMIC UNIT</td><td colspan="3">Chemistry</td></tr>
<tr><td>LEVEL OF STUDIES</td><td colspan="3">Undergraduate</td></tr>
<tr><td>COURSE CODE</td><td>XHY 031</td><td>SEMESTER</td><td>5</td></tr>
<tr><td>COURSE TITLE</td><td colspan="3">Inorganic Chemistry III</td></tr>
</table>

<table>
<tr><td>INDEPENDENT TEACHING ACTIVITIES
<i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i></td><td>WEEKLY TEACHING HOURS</td><td>CREDITS</td></tr>
<tr><td></td><td>4</td><td>5</td></tr>
<tr><td>Laboratory</td><td>0</td><td>0</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td><i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i></td><td></td><td></td></tr>
</table>

<table>
<tr><td>COURSE TYPE
<i>general background, special background, specialised general knowledge, skills development</i></td><td>General background</td></tr>
<tr><td>PREREQUISITE COURSES:</td><td>Inorganic Chemistry I & Inorganic Chemistry II</td></tr>
<tr><td>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</td><td>Greek</td></tr>
<tr><td>IS THE COURSE OFFERED TO ERASMUS STUDENTS</td><td>No</td></tr>
<tr><td>COURSE WEBSITE (URL)</td><td></td></tr>
</table>

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After the successful completion of course of Level 6 descriptor, student will be able to:

- Understand the function of organometallic compounds in biological systems and the application of organometallic compounds.
- Understand the electron transfer reactions and their applications in everyday life (conversion of solar energy to electric one, use of H_2 for energy production etc.)
- Understand the basic principles of the Inorganic Reactions Mechanisms and their relation to basic inorganic reactions.
- Understand the basic catalytic reactions and their relation to stoichiometric inorganic reactions and at the same time to understand the mechanistic path.
- Understand some biological functions as respiration and how do these are related to action of metal complexes

Knowledge

- Knowledge and understanding of the basic principles of organometallic chemistry
- Knowledge and understanding of electron transfer reactions

- Knowledge and understanding of the basic principles, meanings and theories related to inorganic reaction mechanisms.
- Knowledge and understanding of the basic principles, meanings, stoichiometric reactions and mechanisms related to catalytic reactions.
- Knowledge and understanding of fundamental biological functions related to active metal complexes

Skills

- Skills in solving problems related to inorganic reaction mechanisms as well as predicting the molecular structure of reaction products of catalytic processes of industrial interest.
- Skills in solving problems related to organometallic chemistry
- Skills in solving problems related to electron transfer
- Skills in solving problems related to inorganic reaction mechanisms as well as predicting the molecular structure of reaction products of catalytic process.
- Skills in solving problems related to intermediate reactions, molecular structures and oxidation states of catalytic reactions.
- Skills in data analysis in order to explain and/or propose the most probable catalytic cycle taking place.
- Skills in solving problems related to biological function of active metal complexes

Abilities

- Ability to employ its knowledge to deal with problems related to inorganic reaction mechanisms.
- Ability to combine experimental data with those obtained from literature in order to propose a possible reaction mechanism.
- Ability to interact with other students or researchers on topics related to catalytic or/and bio-catalytic reaction mechanisms.

Ability to choose and employ a certain methodology to solve a specific issue of a reaction mechanism related to the metallic center.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general skills acquired by the students after attending the course are the following:

- Theoretical conception and ability to transform this theory to practice.
- Ability to employ the acquired knowledge after completed the course as well as of all the related courses taught in earlier semesters.
- Acquire the most suitable theoretical and practical knowledge background to give the opportunity to attend further training in the framework of postgraduate MSs or even PhD studies.
- Ability to interact at a multi-disciplinary level
- Ability to cooperate at a team level in order to achieve the above targets.

(3) SYLLABUS

Introduction to Organometallic Chemistry. The 18-electron rule. Metal carbonyls/metal nitrosyls. Dinitrogen complexes. Alkene-alkyne- complexes. Carbene and carbine complexes. Carbides. Cyclopentadienyls. Reaction of organometallic compounds. Hydrogen for energy production. Electron transfer-photovoltaic panels. Clusters. Metal-metal bonds. Inorganic reaction mechanisms: metal atoms as centers of acid-base behavior in complexes; the oxidative addition reaction. The insertion reaction. Reactions of coordinated ligands. Catalytic reactions by metal complexes: Isomerization. Hydrogenation. Hydroformylation. Acetic Acid synthesis. Oxidations. Bio-inorganic Chemistry: Metalloporphyrins. Hemocyanine, Tyrosinase. Iron-sulfur proteins. Iron supply and transport.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	- **Communication with the students via e-mail** - **Use of Power Point to support teaching** - **Teaching with projects assignments**
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below

Activity	*Semester workload*
Lectures	52
Personal study and preparation	73
Course total	***125***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Students evaluation is performed via: written final exam in Greek language comprising: ○ Answering questions ○ Questions with short answers ○ Answering critical thinking questions ○ solving problems

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ΒΑΣΙΚΗ ΑΝΟΡΓΑΝΗ ΧΗΜΕΙΑ (Basic Inorganic Chemistry), F. ALBERT COTTON, GEOFFERY WILKINSON, PAUL GAUS, ΠΑΡΙΣΙΑΝΟΥΑ.Ε.., 2015

ΒΑΣΙΚΗ ΟΡΓΑΝΟΜΕΤΑΛΛΙΚΗ ΧΗΜΕΙΑ (Basic Organometallic Chemistry)	HAIDUC IONEL, ZUCKERMAN JERRY J.	ΠΑΠΑΖΗΣΗΣ
ΑΝΟΡΓΑΝΗ ΧΗΜΕΙΑ (Inorganic Chemistry)	CATHERINE E. HOUSECROFT, ALAN G. SHARPE	Ν. ΧΑΤΖΗΛΙΑΔΗΣ, Θ. ΚΑΜΠΑΝΟΣ, Α. ΚΕΡΑΜΙΔΑΣ, Σ. ΠΕΡΛΕΠΕΣ

Ανόργανη Χημεία, James E. Huheey, Harper Collins Eds., 3rd ed., 1983, ISBN 0-06-042987-9

- Related academic journals:

ACS: JACS,ACS Catalysis,Inorganic Chemistry, Organometallics
Elsevier: Journal of Organometallic Chemistry, Chemistry Journal of Molecular Catalysis, Applied Catalysis, Catalysis Communications, Journal of Catalysis.
Wiley: European Journal of Inorganic Chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**6.1**	**SEMESTER**	**6th**
COURSE TITLE	**APPLICATIONS OF STATISTICAL MECHANICS**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on theoretical chemistry and more specifically those of Molecular Quantum Chemistry and Statistical Thermodynamics and their applications. They will learn how to search in literature and analyze data using new technologies. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Working independently
Team work
Respect of natural environment

Promoting free, creative and inductive thinking Understanding analytical science, demonstrate a coherent understanding of the subject Depth and breadth of Statistical Mechanics knowledge Inquiry and problem solving, critically analyze and solve problems in Statistical Mechanics Personal and professional responsibility, be accountable for individual learning and scientific work in Statistical Mechanics

(3) SYLLABUS

Postulates and Formulation of Macroscopic Thermodynamics. Micro-Canonical Ensemble, Boltzmann law. Equilibrium and perturbations. Macromolecules. Diffusion. Canonical Ensemble, Distribution function. Canonical statistical ensemble and applications. Transportation, Rotation and Vibration of molecules. Development of Quantum Mechanics and applications Canonical statistical ensemble – Classical Statistical Mechanics. Chemical reactions – Equilibrium Constants. Kinetic description of dilute gases. Elementary Kinetic Theory of Transport Processes Thermostatic properties of solids and liquids, Einstein and Debye models.

(4) TEACHING and LEARNING METHODS - EVALUATION

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<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Combined use of PowerPoint and classroom board in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>75</td></tr>
<tr><td>Not guided study</td><td>50</td></tr>
<tr><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
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<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

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- Related academic journals:

Journal of Chemical Physics, Journal of Physical Chemistry
and any other international scientific journal of theoretical and computation chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE709 6.1**	**SEMESTER**	**6th**
COURSE TITLE	**APPLICATIONS OF STATISTICAL MECHANICS**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

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Team work
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Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
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Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Working independently
Team work

Respect of natural environment
Promoting free, creative and inductive thinking
Understanding analytical science, demonstrate a coherent understanding of the subject
Depth and breadth of Statistical Mechanics knowledge
Inquiry and problem solving, critically analyze and solve problems in Statistical Mechanics
Personal and professional responsibility, be accountable for individual learning and scientific work in Statistical Mechanics

(3) SYLLABUS

Postulates and Formulation of Macroscopic Thermodynamics. Micro-Canonical Ensemble, Boltzmann law. Equilibrium and perturbations.
Macromolecules. Diffusion. Canonical Ensemble, Distribution function.
Canonical statistical ensemble and applications. Transportation, Rotation and Vibration of molecules. Development of Quantum Mechanics and applications
Canonical statistical ensemble – Classical Statistical Mechanics.
Chemical reactions – Equilibrium Constants.
Kinetic description of dilute gases. Elementary Kinetic Theory of Transport Processes
Thermostatic properties of solids and liquids, Einstein and Debye models.

(4) TEACHING and LEARNING METHODS - EVALUATION

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<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
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<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Combined use of PowerPoint and classroom board in lectures.
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<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>75</td></tr>
<tr><td>Not guided study</td><td>50</td></tr>
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<tr><td>Course total</td><td>125</td></tr>
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</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

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- Ο ΧΗΜΙΚΟΣ ΔΕΣΜΟΣ, MURELL J.N., KETTLE S.A., TEDDER J.N., Εκδόσεις ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ
- ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΚΒΑΝΤΙΚΗ ΧΗΜΕΙΑ, ΤΣΙΠΗΣ ΚΩΝ/ΝΟΣ, Εκδόσεις ΖΗΤΗ ΠΕΛΑΓΙΑ ΚΑΙ

ΣΙΑ Ο.Ε.
- Related academic journals:
Journal of Chemical Physics, Journal of Physical Chemistry
and any other international scientific journal of theoretical and computation chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHY 066**	**SEMESTER**	**6**
COURSE TITLE	**Laboratory of Organic Chemistry II**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	10	10
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised General Knowledge/Skills Development
PREREQUISITE COURSES:	According to the curriculum of the Department of Chemistry, there are no prerequisites, but it is not possible to carry out effective monitoring without the necessary knowledge of the Organic Chemistry I, II and III courses as well as of the Laboratories of the Introductory Laboratory and Organic Chemistry.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Learning objectives

• The main objective of the Organic Chemistry Laboratory II for each student of the Department of Chemistry, since it has been informed and learned basic knowledge in the laboratory techniques of isolation, separation, purification and identification of organic compounds in the Laboratory of Organic Chemistry I, is to acquire experimental competence concerning:

• synthesis of organic compounds
• the isolation of the organic molecules produced
• cleaning them and finally
• their characterization.

Knowledge

Knowledge and understanding of the basic concepts, principles and theories related to the synthesis and physical chemical characterization of organic compounds.

Skills

Skills in the synthesis and purification of organic compounds.

Complex problem-solving skills through careful analysis of the provided data.

Abilities

Ability to apply the provided knowledge to the problem (theoretical and synthetic) related to Organic Chemistry.

Ability to synthesize organic compounds in pure form.

Ability to interpret spectroscopic data.

Ability to work independently and to interact with other students on subject matter.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competencies the student should have acquired and to which the course is aimed are:

Search, analyze and synthesize data and information and make decisions.

Conversion of theory into practice.

Promote free, creative and inductive thinking.

Autonomous but also teamwork.

Acquiring appropriate theoretical and practical knowledge base to enable further education both at a theoretical level (in more specific subjects of organic chemistry) and in a laboratory.

(3) SYLLABUS

In particular, the course consists of the following subjects:

The main objective of the Organic Chemistry II Laboratory for each student of the Department of Chemistry is to acquire experimental readiness and to acquire basic knowledge that has been previously informed and learned about the laboratory techniques of isolation, separation, purification and identification of organic compounds in the Organic Chemistry I Laboratory.

concern:

- synthesis of organic compounds
- the isolation of the organic molecules produced
- cleaning them and finally
- their characterization.

The experiments are:

1. Preparation of the compound methyl orange

Description of the topic: The preparation of the compound "methyl orange" is described. In principle, the compound formation reaction and its exact mechanism are studied. Useful points are then given (i.e. what the student should watch during the experiment, first aid, etc.). Below is a list of reagents and analytically the method of preparation of methyl orange. Finally, the UV spectrum of the compound produced is shown.

Keywords: methyl orange, synthesis, isolation, purification, characterization.

2. Preparation of the compound Diphenylmethanol

Description of the topic: The preparation of the compound diphenylmethanol (benzhydrol) is described. In principle, the reaction and its exact mechanism are studied. Useful points are then given (i.e. what the student should watch during the experiment, first aid, etc.). Below is a list of reagents and analytical method for the preparation of diphenylmethanol. Finally, observations, explanations, questions as well as (^{13} C-NMR, IR, MS) are given.

Keywords: Reduction of ketone to alcohol (with sodium borohydride), diphenylmethanol, synthesis, isolation, purification, characterization.

3. Preparation of the compound Ethyll Benzoate (A) and methyl ester (B)

Description of the topic: The preparation of the compounds (a) ethyl benzoate and (b) methyl benzoate are described. In principle, the formation reactions and their precise mechanisms are studied. Useful points are then given (i.e. what the student should watch during the experiment, first aid, etc.). Below is a list of reagents and analytical methods for the preparation of ethyl benzoate and methyl benzoate. Finally, observations, explanations, questions as well as the (^{13}C-NMR, IR, MS) spectra of the compounds prepared were given.

Keywords: Ethyl benzoate, methyl benzoate, carboxylic acid esterification with alcohol and acid catalysis (Fischer), synthesis, isolation, purification, characterization.

4. Saponification of olive oil

Description of the topic: Describe the saponification of olive oil. In principle, the saponification reaction and its mechanism are studied. Below is a list of reagents and analytically the method of preparation of the product. Finally, observations, explanations and questions about the course of laboratory work are given.

Keywords: Saponification of olive oil, alkaline hydrolysis of carboxylic acid ester, synthesis, isolation, purification, characterization.

5. Formation of the compound Benzylideneaniline (imine) and N-Benzylaniline (N-phenylbenzylamine)

Description of the topic: The preparation of compounds (a) Benzylideneaniline (imine) and (b) *N*-Benzylaniline (*N*-phenylbenzylamine) are described. Initially, the formation reactions of these compounds and their precise mechanisms are studied. A list of reagents and analytical methods for the preparation of benzylideneaniline (imine) and (b) *N*-benzylaniline (*N*-phenylbenzyl-amine) are shown below. Finally, observations, explanations, questions as well as the (^{13}C-NMR, IR, MS) spectra of the compounds prepared were given.

Keywords: Benzylideneaniline (imine), *N*-Benzylaniline (*N*-phenylbenzylamine), nucleophilic addition of amine to aldehyde and water removal, imine reduction, preparations, synthesis, isolation, purification, characterization.

6. Preparation of Acetophenone (E) -Oxime

Description of the topic: The preparation of Acetophenone (E) -Oxime is described. Initially, the formation reaction of acetophenone (E) -Oxime and its exact mechanism are studied. Below is a list of reagents and analytical method for making the compound. Finally, observations are made on the course of the exercise.

Keywords: Condensation of a carbonyl compound with hydroxylamine, oxime formation, preparation, synthesis, isolation, purification, characterization.

7. Preparation of the compound Acetylsalicylic acid (2-acetoxybenzoic acid, aspirin).

Description of the topic: The preparation of the compound Acetylsalicylic acid (2-acetoxy-benzoic acid, aspirin) is described. In principle, the reaction and its exact mechanism are studied. Useful points are then given (eg what the student should watch during exercise, first aid, etc.). Below is a list of reagents and analytically the method of preparing the compound acetylsalicylic acid (2-acetoxybenzoic acid, aspirin). Finally, observations, explanations, questions concerning the course of the exercise as well as the (^{13}C-NMR, IR, MS) spectra of the compound produced are given.

Keywords: Pyrophilic acyl-substitution, esterification, acetylsalicylic acid, 2-acetoxybenzoic acid, aspirin, synthesis, isolation, purification, characterization.

8. Preparation of Benzimidazole

Description of the topic: The preparation of the benzimidazole compound is described. In principle, the compound formation reaction and its exact mechanism are studied. Useful points are then given (eg what the student should watch during exercise, first aid, etc.). Below is a list of reagents and analytically the method of preparation of the benzimidazole. Finally, observations, explanations, questions concerning the course of the exercise as well as the (^{13}C-NMR, IR, MS) spectra of the compound produced are given.

Keywords: Diamines condensation with carboxylic acid, heterocyclic ring formation, benzimidazole, synthesis, isolation, purification, characterization.

9. Diels-Alder cycloaddition reaction

Description of the topic: Describe the Diels-Alder cycloaddition reaction (7-oxabicyclo [2.2.1] hept-5-ene-2,3-exo-dicarboxylic anhydride). In principle, the Diels-Alder cycloaddition reaction and its mechanism are studied. Below is a list of reagents and analytically the method of preparation of the product. Finally, observations and explanations are given on the course of laboratory work.
Keywords: Diels-Alder reaction, [4n+2]cycloaddition reaction, furan, maleic anhydride, synthesis, isolation, purification, characterization

10. Preparation of the compound 1,1-Diphenyl-1-pentanol and 1,1-diphenyl-1-pentene

Description of the topic: The preparation of compounds (a) 1,1-Diphenyl-1-pentanol and (b) 1,1-diphenyl-1-pentene. Initially, the formation reactions of these compounds and their precise mechanisms are studied. The following are the list of reagents and analytical methods for the preparation of 1,1-diphenyl-1-pentanol and 1,1-diphenyl-1-pentene.
Keywords: 1,1-Diphenyl-1-pentanol, 1,1-diphenyl-1-pentene, n-butylmagnesium bromide, preparation of Grignard reagent, addition of Grignard reagent to ketone, alcohol hydrolysis, alcohol dehydration in alkene, isolation, purification, characterization.

11. Carbonyl Protection - Acetal Formation

Description of the topic: Describe the protection of the carbonyl and the formation of the acetal. At first, the acetal formation reaction and the precise mechanism of the acetal is studied. Below is a list of reagents and analytical method for the preparation of the acetal. Finally, there are explanations on the course of the exercise.
Keywords: Ketone carbonyl protection, carbonyl protection, acetal formation, synthesis, isolation, purification, characterization.

12. Amino acid protection: Fmoc-alanine, Fmoc-Ala

Description of the topic: The amino acid protection of amino acids is described: N - [(9H-fluoren-9-ylmethyloxy) carbonyl] -alanine (Fmoc-alanine, Fmoc-Ala). Initially, the reaction is studied: Fmoc-protection of the α-amino group of the amino acids. Below is a list of reagents and analytical method for preparing Fmoc-Ala. Finally, comments, explanations, questions concerning the course of laboratory work and the product are presented, as well as the relevant literature.
Keywords: amino acid amino acid protection, Fmoc-alanine, Fmoc-Ala, synthesis, isolation, purification, characterization

13. Preparation of Nylon – 6,10

Description of the topic: Describe the preparation of the Nylon compound – 6,10. In principle, the compound formation reaction, i.e. polymerization (polycondensation), is studied. Below is a list of reagents and analytical method of preparation of nylon - 6,10.
Keywords: Nylon - 6,10, polymerization, polycondensation

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of ICT (laboratory exercises) in lectures and laboratory exercises. Posting additional notes, exercises etc. on the teachers' websites. Communicating with students via e-mail</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures-Suggestions</td><td>26</td></tr>
<tr><td>Laboratory experiment</td><td>104</td></tr>
<tr><td>Writing assignments</td><td>48</td></tr>
<tr><td>Individual study and preparation</td><td>46</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td rowspan="6">visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>250</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td colspan="2">Written examination with questions of understanding of matter and basic concepts, multiple choice, matching, correct-to-short and short-term
Laboratory exercises

50% of the final grade is the written exam, and the remaining 50% is the grade of written work and laboratory exercises

The evaluation criteria are announced at the beginning of the course and posted on the electronic bulletin board</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Suggested Books

1. Techniques in Organic Chemistry: Miniscale, Standard Taper Microscale, and Williamson Microscale by Jerry R. Mohrig (Author), Christina Noring Hammond (Author), Paul F. Schatz (Author).
2. JohnMcMurry: Οργανική Χημεία, Πανεπιστημιακές Εκδόσεις Κρήτης.
3. ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΤΟΥ ΕΡΓΑΣΤΗΡΙΟΥ ΟΡΓΑΝΙΚΗΣ ΧΗΜΕΙΑΣ ΙΙ ΜΕΛΗ ΔΕΠ ΟΡΓΑΝΙΚΗΣ ΧΗΜΕΙΑΣ ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)

Additional bibliography

(1) Caprino, L. A.; Han, G. A. *J. Org. Chem.* **1972**, *37*, 3404

(2) Bodanszky, M. *Int. J. Peprtide Protein Res*. **1985**, *25*, 449

(3) Chinchilla, R., Dodsworth, D. J., NaJera, C.; Soriano, J. M. *Bioorg. Med. Chem. Lett*. **2002**, *12*, 1817

(4) Bolin, D. R.; Sytwu, J.-I.; Humiec, F.; Meienhofer, J. *Int. J. Peptide Protein Res*. **1989**, *33*, 353

(5) Webster, K.; Maude, A. B.; O'Donnel, E. Mehrota A. M. Gani, D. *J. Chem. Soc*., *Perkin Trans. 1*, **2001**, 1673.

(6) Merrifield, R. B. *J. Am. Chem. Soc*. **1963**, *85*, 2149.

(7) Chang, C. D.; Waki, M.; Ahmad, M.; Meienhofer, J.; Lundell, E. O.; Hang, J. D. *Int. J. Pept. Protein Res*. **1980**, *15*, 59-66.

(8) Gisin, B. F. *Anal. Chim. Acta* **1972**, *58*, 248

(9) Organicum, 19η Έκδοση, Johann Ambrosius Barth Verlag, Λειψία (Γερμανία), 1993, σελ. 173

(10) Bodanszky, M., and Bodanszky, A., *The practice of peptide synthesis*, Springer-Verlag, Berlin Heidelberg, 1984.

(11) Itoh, M., Hagiwara, D., Kamiya, T., *Tetrahedron Letters*, 1975, 4393.

(12) Itoh, M., Hagiwara, D., Kamiya, T., *Bull. Chem. Soc. Japan*, 1977, **50**, 718.

(13) Tarbell, D. S., Yamamoto, Y., Pope, B. M., *Proc. Nat. Acad. Sci*. USA, 1972, **69**, 730.

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHY057 6.1**	**SEMESTER**	**6th**
COURSE TITLE	**Physical Chemistry III**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on theoretical chemistry and more specifically those of Molecular Quantum Chemistry and Statistical Thermodynamics and their applications. They will learn how to search in literature and analyze data using new technologies. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Working independently
Team work

Respect of natural environment
Promoting free, creative and inductive thinking
Understanding analytical science, demonstrate a coherent understanding of Physical Chemistry
Depth and breadth of Physical Chemistry knowledge
Inquiry and problem solving, critically analyse and solve problems in Physical Chemistry
Personal and professional responsibility, be accountable for individual learning and scientific work in Physical Chemistry

(3) SYLLABUS

Structure of multi-electron atoms. Slater determinants. Pauli principle. Introduction to molecular quantum chemistry. Born-Oppenheimer approximation. Molecular structure: diatomic atoms. Valence bond theory, Theory of diffuse molecular orbitals and perturbation theory. Molecular symmetry – group theory. Applications of symmetry in molecular orbital theory – Polyatomic molecules. Theory of diffuse molecular orbitals – Hybridization of orbitals. Computational techniques in quantum chemistry – Hückel's method and the prediction of molecular properties. Kinetic theory, theory of active complex, dynamics of molecular collisions. Statistical thermodynamics: distribution of molecular states. Statistical thermodynamics: internal energy and entropy. Statistical thermodynamics: normal distribution function, degrees of freedom. Applications of statistical thermodynamics, specific heats, equilibrium constants. Statistical properties of macromolecules – Colloids.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Combined use of PowerPoint and classroom board in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination in Greek, with multiple choice questionnaires and short-answer questions.

Activity	***Semester workload***
Lectures	75
Not guided study	50
Course total	125

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- ΦΥΣΙΚΟΧΗΜΕΙΑ, ΚΑΤΣΑΝΟΣ ΝΙΚΟΛΑΟΣ, Α. Εκδόσεις ΠΑΠΑΖΗΣΗΣ
- ΜΟΡΙΑΚΗ ΚΒΑΝΤΙΚΗ ΜΗΧΑΝΙΚΗ, ATKINS PETER WILLIAM, Εκδόσεις ΠΑΠΑΖΗΣΗΣ
- Ο ΧΗΜΙΚΟΣ ΔΕΣΜΟΣ, MURELL J.N., KETTLE S.A., TEDDER J.N., Εκδόσεις ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ

- ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΚΒΑΝΤΙΚΗ ΧΗΜΕΙΑ, ΤΣΙΠΗΣ ΚΩΝ/ΝΟΣ, Εκδόσεις ΖΗΤΗ ΠΕΛΑΓΙΑ ΚΑΙ ΣΙΑ Ο.Ε.

- Related academic journals:

Journal of Chemical Physics, Journal of Physical Chemistry
and any other international scientific journal of theoretical and computation chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE		**SEMESTER**	**7th**
COURSE TITLE	ADVANCED ENVIRONMENTAL PROTECTION TECHNOLOGIES - PHOTOCATALYSIS		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
LECTURES	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	-

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After the successful completion of the course, descriptive level 6 of the European Qualifications Framework for Lifelong Learning, the students will obtain knowledge on the principles of advanced technologies (advanced oxidation processes, photocatalysis, membrane separation, biological processes, nanomaterials based applications, etc.) and they will develop skills for their applications for water, wastewater and air treatment, remediation of polluted natural resources. In addition, the students will inquire knowledge in principles and technologies for the prevention of pollution in industrial chemical production planning and production, environmental pollution and toxicity to humans according to the principles of ‘’green chemistry’’ and ‘’green chemical technology’’.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and	*Project planning and management*

information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
......
Others...
....

- Application of knowledge dealing with advanced methods, techniques and technologies of pollution control and environmental protection-remediation.
- Inquiring of theoretical and practical background for performing further education, postgraduate and doctoral studies.
- Utilization of laboratory infrastructures and equipment for the above-mentioned aims
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Theoretical knowledge and bringing-applying theory to practice
- Team work as well as working independently
- Working in an international environment
- Working in an interdisciplinary environment
- Production of new research ideas
- Project planning and management
- Respect for the natural environment

(3) SYLLABUS

Advanced Oxidation Processes (AOPs) and technologies for environmental remediation: Homogeneous and Heterogeneous processes; UV-photolysis; UV/H_2O_2 processes; Fenton and photo-Fenton processes; Persulfate oxidation processes, In-Situ oxidation, Semiconductor Photocatalysis, Mechanisms of the photocatalytic degradation of organic pollutants, Photocatalytic reaction engineering, Solar photocatalysis, Electrochemical and photoelectrocatalysis treatment, Ultrasound processes (Sonolysis), Radiation processes, Wet air oxidation processes; Advantages and limitations of AOPs, Application of AOPs, in water, wastewater and soil remediation, Hybrid processes based on AOPs and biological methods, Membrane-based separation technologies, Hybrid processes based on AOPs, biological methods and membrane technologies, Nanotechnologies (carbon, iron based nanomaterials, etc.) for environmental protection and remediation, New trends in pollution prevention and control, Green Chemistry and Green Chemical Technology concepts in environmental protection and remediation.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of Technologies of Information and communications in teaching and communication with students.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational</i></td><td><table><tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr><tr><td>Lectures</td><td>52</td></tr><tr><td>Written assignment</td><td>30</td></tr><tr><td>Not guided study</td><td>43</td></tr></table></td></tr>
</table>

visits, project, essay writing, artistic creativity, etc. *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*		
	Course total	**125**
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek with a combination of open-ended questions, multiple choice questionnaires, short-answer questions and written work with public presentation (20%).	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography (in Greek):

1) Wastewater Engineering: treatment and Reuse – Metcalf & Eddie, Part B, Translated in Greek, Eds. A. Tziola and Sons,
2) I. Konstantinou, University of Ioannina (Notes)

- Suggested bibliography (in English):

1) Advanced Oxidation Processes for Water and Wastewater Treatment, Ed. S. Parsons, IWA, 2004, ISBN: 9781843390176
2) Advanced Oxidation Processes for Water Treatment, Ed. Mihaela I. Stefan, IWA, 2017, ISBN:9781780407180.
3) Photochemical Purification of Water and Air: Advanced Oxidation Processes (AOPs) - Principles, Reaction Mechanisms, Reactor Concepts, Thomas Oppenländer, Wiley-VCH, 2003, ISBN: 978-3527305636
4) Photocatalysis: Applications (Energy and Environment Series) by D.D. Dionysiou(Editor), G. Li Puma(Editor), J.Ye (Editor), Royal Society of Chemistry;2016, ISBN: 978-1782627098

- Related academic journals:

1) Applied Catalysis B:Environmental
2) Environmental Science and Technology
3) Catalysis Today
4) Journal of Chemical Technology and Biotechnology
5) Chemical Engineering Journal
6) Journal of Advanced Oxidation Technologies
7) Green Chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHE 715**	**SEMESTER**	**7**
COURSE TITLE	ADVANCED FOOD –ENOLOGY LABORATORY		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general knowledge, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, level 6 of the European Qualifications Frame work, students will be able to perform various chemical, biochemical and microbiological analyses of foods and wine.
Moreover, they will be able to solve problems and exercises related to the subjects of the course, and to correlate analytical data with properties of foods and wine as well as their quality and assurance. They will be able to conduct a literature search using modern technologies.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology. Working independently. Criticism and self-criticism. Production of free, creative and inductive thinking.

(3) SYLLABUS

Enzyme and microbial activities in dairy and enology.
Antioxidant activity and oxidation of oils and fruit juices.
Analysis and must and correction of its acidity and sugar.
Wine analyses.
Control of wine stability.
Chromatic characteristics and phenolic composition of wine.
Food colourants and evaluation of food colour.
Determination of ascorbic acid in foods using HPLC.
Determination of fatty acids in oil – control of oil adulteration.
Microbiological analysis of foods.
Determination of yogurt and wine aroma volatiles by using SPME-GC/MS.
Specific wine analyses.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of power point in lectures. Use of ICT technologies in communication with students.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	The language of evaluation is Greek. The total evaluation consists of a) written examination (50 %), with open-ended questions, short-answer questions and multiple choice questionnaires, and b) laboratory work and reports (50 %).

Activity	***Semester workload***
Lectures	8
Laboratory practice	44
Study and analysis of bibliography, essay writing	33
Not guided study	40
Course total	**125**

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

LABORATORY EXERCISES OF FOOD AND WINE SCIENCE ΕΡΓΑΣΤΗΡΙΑΚΕΣ	*ROUSSIS I., BADEKA A., PIPERIDI C., RIGANAKOS K., SAVVAIDIS I., KOSMA I., TASIOULA-MARGARI M.*	*UNIVERSITY OF IOANNINA*

- Related academic journals:

1. Journal of Food Composition and Analysis
2. Food Analytical Methods
3. Food Chemistry
4. Food Research International
5. Journal of Agricultural and Food Chemistry
6. *American Journal of Enology and Viticulture*
7. *Australian Journal of Grape and Wine Research*
8. *Journal international Sciences de la Vigne et du Vin*
9. *South African Journal of Enology and Viticulture*

- Related books:

1. Food Analysis, Nielsen S., Springer 2010.

2. Handbook of Food Analysis. Nollet L.M.L., Marcel Dekker 2004.

5. Methods for Analysis of Must and Wine, Ough C.S., Amerine M.A., Wiley 1988.

6. Wine Analysis and Production, Zoecklein B.W., Chapman and Hall 1994.

7. Chemical Analysis of Grapes and Wine Techniques and Concepts, Patrick Iland Wine Production, 2013.

8. Wine and Spirits. Methods of analysis. Soufleros E. Stamoulis Publishing 2000.

COURSE OUTLINE

(1) GENERAL

SCHOOL	**School of Sciences**		
ACADEMIC UNIT	**Department of Chemistry**		
LEVEL OF STUDIES	**Undergraduate**		
COURSE CODE	**XHE410**	**SEMESTER**	**7**
COURSE TITLE	**Biological Membranes and Basic Principles in Signal Transduction**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	4
Project preparation	1	1
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	*General background* *Special background, specialised* *Skills*
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=596

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course, are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The course covers basic and specific knowledge starting from molecular level to the architecture of biomembranes, stipulated by chemical/physicochemical features, their biogenesis, ending up to functional issues pointing at biosignalling at a basic level).

With the successful completion of the course the students will acquire the specific knowledge and skills to:

- List the molecular components of biomembranes and describe their chemical /physicochemical properties
- Describe how the components of biological membranes interact to compose the supermolecular structures of biomembranes
- List and describe isolation and characterization techniques of for studying biological membranes
- Explain the basic principles of the fluid mosaic model of biomembranes.
- Outline the physicochemical properties of the lipid bilayers and associated proteins that compose biomembranes.
- List the functions of membrane proteins and explain the different ways proteins can be associated with a membrane.

- Describe the factors involved in membrane fluidity and assymetry.
- Describe the principles of membrane biogenesis and topology of lipid and protein assemblies formation in eukaryotic cells
- Describe the concept of cell communication.
- List the differences between neuronal and endocrine communication.
- Describe the concept of receptor affinity
- Describe the basic scheme of signal transduction levels.
- Understand the basic principles of signal transduction mechanisms, in particular the concepts of response specificity, signal amplitude and duration, signal integration and intracellular location
- Give examples of different types of extracellular signals and receptors, and explain their functional significance
- Describe the mechanisms by which different receptors may be activated by their respective ligands
- Describe and give examples of the structure and properties of the major components of signal transduction pathways.
- Explain the kinetics of ligand-receptor association
- Compile the above knowledge to describe sensory systems

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search, analysis and synthesis of data and information, by using the proper technologies.
- Autonomous work
- *Working in an interdisciplinary environment*
- Promoting free, creative and inductive thinking

(3) SYLLABUS

The Foundations of Biochemistry. Molecular ierarchy in cell structure. Cell fractionation, membrane purification (chromatographic techniques). Membrane characterization (enzymic /morphological markers). Microscopes. Composition of biological membranes. Lipids, proteins carbohydrates. Terminology of lipids. Structural features of saturated and unsaturated fatty acids. Major and minor phospholipids of biological membranes. Molecular species. Structures. Lipid polymorphism. Characteristic enzymic and chemical reactions. Chemical and physicochemical properties. Critical micellar concentration. Phospholipases –catalysis models – products. Lipid analysis (TLC, GC, HPLC), and characterization (mass spectrometry of lipids, LC/MS). Bioactive lipids.
Membrane proteins (structural features, bonds, isolation methods and characterization). Chaotropic agents/detergents. Hydrophilic/lipophilic balance. Lipid-binding proteins, lipid-exchange proteins, lipoproteins, annexins, caveolines, transporters, ion channels. Membrane formations. Membrane fluidity and asymmetry. Lipid rafts. Cytoskeleton, extracellular matrix. Membrane biogenesis (sorting, targeting, compartmentalisation. Exosomes. Fluid mosaic model. Plasma membrane and intracellular membranes.
Cell communication. Cell Signalling. Types of plasma membrane receptors. Channels, enzyme receptors, G-protein-coupled receptors. Effectors, Intracellular signals. Phospholipase C, A_2, D. Phosphatidylinositol cycle. Characteristics of cell signalling, signal amplification, signal cascades. Mechanisms of cell desensitization, adaptation. Scatchard analysis. Sensory systems.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to Face
USE OF INFORMATION AND	Use of PowerPoint in lectures.

COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Projection and analysis of scientific videos Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (70%) in Greek, with questions for analytical answers, multiple choice and short-answer questions. Written projects with public presentation (30%).

Activity	***Semester workload***
Lectures	55
Bibliographical search	20
Preparation and writing of projects	30
Projects presentation	20
Course total	***125***

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Lehninger Principles of Biochemistry 7th Edition by David L. Nelson, Michael M. Cox, W.H. Freeman, 2017
- Molecular Biology of THE CELL. Alberts B., Bray D., K. Johnson A., Lewis J., Raff M., Roberts K., Walter P. Garland Sci
- ΒΙΟΛΟΓΙΚΕΣ ΜΕΜΒΡΑΝΕΣ ΚΑΙ ΜΕΤΑΓΩΓΗ ΣΗΜΑΤΟΣ ΣΗΜΕΙΩΣΕΙΣ ΤΟΥ ΔΙΔΑΣΚΟΝΤΑ ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ
- Βιολογικές μεμβράνες. Από τη δομή στις λειτουργίες. Θεωρία και πειραματικές προσεγγίσεις ΜΕ Λέκκα, Γ Λεονταρίτης, Κ Γαλανοπούλου, Ει Κητσιούλη ISBN: 978-960-603-387-2, [ηλεκτρ. βιβλ.] Αθήνα:Σύνδεσμος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών. www.kallipos.gr. In http://hdl.handle.net/11419/4307

- Related academic journals:

- Biological Membranes - OMICS Publishing Group
- BBA Biomembranes, ISSN: 0005-2736
- Journal of Signal Transduction — An Open Access Journal https://www.hindawi.com/journals/jst
- Trends in Biochemical Sciences - Journal - Elsevier https://www.journals.elsevier.com

- *Nature Reviews Molecular Cell Biology* www.nature.com/nrm

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE807**	**SEMESTER**	**H'**
COURSE TITLE	Contemporary spectroscopic methods for the identification of organic molecules		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
LECTURES	3	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge
PREREQUISITE COURSES:	According to the curriculum of the Department of Chemistry there are no prerequisites, but it is not possible to monitor effectively without the required knowledge of Organic Chemistry I and II
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (possibility of teaching in English). All the power point curriculum is in English.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	-

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, level descriptor 6 of the European Qualifications Framework, students should be able to:

• Understand the basic principles of spectroscopy of organic compounds, especially infrared-visible spectroscopy, vibrational spectroscopy, nuclear magnetic resonance and mass spectrometry, and how they can be used for the identification and solution of structures of unknown organic compounds.

• Explain UV-visible, infrared, nuclear magnetic resonance and mass spectra, identify characteristic spectral peaks, evaluate spectral data by identifying and solving structures of organic compounds.

• Choose and apply the appropriate spectroscopic technique or combination of spectroscopic techniques to solve research problems.

Knowledge

• Knowledge and understanding of the basic concepts, principles and theories related to spectroscopy of organic compounds.

• Knowledge and understanding of applications of UV / Vis spectroscopic methods, IR,

NMR and MS in identifying and solving structures of organic compounds.
- Knowledge of the combined use of UV / Vis, IR, NMR and MS techniques in identifying and solving structures of organic compounds.
- Knowledge of the use of spectroscopic data in the international literature.

Skills
- Skills to solve and evaluate UV / Vis, IR, NMR and MS spectra.
- Use of the appropriate spectroscopic method or a combination of methods to solve complex problems of Organic Chemistry.
- Advanced problem solving skills through data analysis of international literature.

Competences
- Ability to apply knowledge in dealing with problems related to spectroscopy of organic compounds.
- Ability to interpret spectral data with the use of one or more techniques and to determine the structure of organic compounds.
- Ability to analyze spectroscopic data and investigate structural and conformational properties of the molecules.
- Ability to interact with other students or researchers in solving spectroscopic problems of organic compounds.
- Ability to select and apply the most appropriate spectroscopic methods and relevant methodology to solve specific research problem.
- Ability to work in a team but also individually.
- Job opportunities in an international environment.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competences are:
- Theoretical thinking and ability to translate theory into practice.
- Ability to apply knowledge acquired during the study period in related courses of the curriculum of the Department of Chemistry.
- Ability to search, analyze and synthesize data and information from international literature and use the necessary technologies related to the presentation of research results.
- Acquiring the appropriate theoretical and practical knowledge to be able to follow further education at postgraduate and doctoral level.
- Working in an interdisciplinary environment.
- Ability to collaborate at a team level.

(3) SYLLABUS

UV-VIS spectroscopy
- Introduction to spectroscopic methods of analysis of organic compounds.
- Electromagnetic radiation
- UV radiation and electronic excitation

- Electronic transitions and selection rules
- Spectra and instrumentation - Beer-Lambert Law
- Chromophoric groups
- Visible spectroscopy
- Exercises - Interpretation of UV-VIS spectra

IR spectroscopy

- Basic concepts of infrared spectroscopy
- Masses, atoms and springs
- Frequency of infrared vibrations of diatomic molecules
- Absorption bands
- Symmetrical vibration, anti-symmetrical vibration, bending vibration
- Simple harmonic oscillator - Non-harmonic oscillator - Factors influencing infrared vibrational frequencies
- Exercises - Interpretation of infrared spectra of a representative number of organic compounds

NMR spectroscopy

- Introduction to NMR spectroscopy - The NMR phenomenon
- Chemical shift
- Characteristic ^{1}H NMR chemical shifts
- Integration of ^{1}H NMR signals
- Spin-spin coupling constants - Analysis of conformation of organic compounds
- Instrumentation – The NMR spectrometer
- ^{13} C NMR spectroscopy
- Fourier Transform NMR Spectroscopy
- Relaxation processes
- NMR time scale - Study of chemical exchange phenomena
- Principles of two-dimensional NMR spectroscopy
- Exercises - interpretation of NMR spectra of a representative number of organic compounds

MS mass spectrometry

- Principles of MS spectrometry
- Ionization energies of valence electrons
- Basic instrumentation of mass spectrometers
- Peaks of molecular ions
- The mass spectrum
- Isotopes
- Ion production methods
- Peaks M + 2 and M + 1
- High resolution mass spectrometry
- Fission fragments
- Exercises - interpretation of MS spectra of a representative number of organic compounds

Combined exercises

- Exercises for combined use of UV / Vis, IR, NMR and MS spectroscopic methods.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to Face Practical application and demonstration at the NMR Center of the University of Ioannina
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of Technologies of Information and communications in teaching and communication with students. Teaching with the project method.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek with a combination of open-ended questions, multiple choice questionnaires, short-answer questions and written work with public presentation (20%). The evaluation of the students is done by written final examination (evaluation) in Greek which includes: I. Written / oral final examination (60%) comprising: – the development of topics – short answer questions – answers to crisis questions – a problem solving. II. Atomic Work Presentation (Concluding Assessment) (40%).

Activity	*Semester workload*
Lectures	50
Written assignment	50
Individual study, preparation	25
Course total	**125**

(5) ATTACHED BIBLIOGRAPHY

- Proposed Electronic Bibliography:

1. *http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction#IRSpectroscopy*
2. *http://chemwiki.ucdavis.edu/Organic_Chemistry/Organic_Chemistry_With_a_Biological_Emphasis/Chapter_04%3A_Structure_Determination_I/Section_4.3%3A_Ultraviolet_and_visible_spectroscopy*

3. *http://www.slideshare.net/RabbyIstik/uv-spectroscopy-collected?related=2*
4. *http://chemwiki.ucdavis.edu/Organic_Chemistry/Spectroscopy/Infrared_Spectroscopy*
5. *https://www.utdallas.edu/~scortes/ochem/OChem_Lab1/recit_notes/ir_presentation.pdf*
6. *https://drive.google.com/folderview?id=0B3uVX4mPJSC1WFVuWkloUUVyMU0&usp/preview&tid=0B3uVX4mPJSC1Y3hOLWh0VUNBbzA#list*
7. *http://chemwiki.ucdavis.edu/Organic_Chemistry/Spectroscopy/Nuclear_Magnetic_Resonance_Spectroscopy*
8. *http://www.mhhe.com/physsci/chemistry/carey/student/olc/ch13nmr.html*
9. *http://www.chem.ucalgary.ca/courses/350/Carey5th/Ch13/ch13-nmr-1.html*
10. *https://www.youtube.com/watch?v=NuIH9-6Fm6U*
11. *http://chemwiki.ucdavis.edu/Organic_Chemistry/Spectroscopy/Mass_Spectrometry*
12. *https://www.youtube.com/watch?v=tOGM2gOHKPc*
13. *http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/maspec.html#c1*

- Books:

1) Introduction to Spectroscopy, D.L Pavia, G.M. Lampman, G.S. Kriz, J.A. Vyvyan, Brooks/Cole (2008).
2) Spectroscopic Identification of Organic Compounds, 7th Edition, R.M. Silverstein, F.X. Webster, D. Kiemle, Wiley (2005).

- **Scientific Journals:**

1) Journal of Chemical Education
2) Concepts in Magnetic Resonance
3) Magnetic Resonance in Chemistry
4) Journal of Molecular Structure.

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE 809**	**SEMESTER**	**7th**
COURSE TITLE	**CRYSTAL CHEMISTRY-CRYSTALLOGRAPHY**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

. After completion of this course, the students should be able to:

Understand the basic principles of crystal geometry,i.e. crystal lattice, molecular and crystalline symmetry,space groups and reciprocal lattice.

Understand X-Ray diffraction from single crystals and crystalline powder.

Describe the intermolecular forces stabilizing the structure and correlate structure with physical or chemical properties.

Knowledge

Knowledge and understanding of basic concepts and theories of crystal and molecular structure determination from X-Ray diffraction data.

Knowledge about the interplay of different intermolecular forces to stabilize the crystalline solids and correlation with properties such as: Polymorphic phenomena, adsorption properties, non-linear optical properties and photochemical solid state reactions.

Skills

Skills in growing single crystals suitable for structure determination.
Crystal structure determination using Direct and Patterson techniques.

Cababilities

Cabability to interpret X-Ray data for structure determination or phase identification.
Cabability to “interpret” structures using intermolecular forces.
Cabability to interact with other scientists in issues concerning Synthetic Chemistry, Materials Science and Pharmaceutics.
Cabability in team work.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general cababilities which should be obtained by the student are:
Ability to work independently.
Ability to work in multidisciplinary environment.
Ability to search, analyze and present data from international literature.
Ability to convert theory into practice.

(3) SYLLABUS

Crystals and crystal lattices.Symmetry.Crystalline systems and geometry.Space groups and equivalent positions.X.Ray diffraction.Determination of crystal structure.Use of crystallographic tables.Examples of crystal structures.Intermolecular forces in solids.Crystal growth.Structure/properties correlation

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Ex cathedra. Practical application and demonstration in the Crystallography Laboratory.

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see workload table below
STUDENT PERFORMANCE EVALUATION **Description of the evaluation procedure** **Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other** **Specifically-defined evaluation criteria are given, and if and where they are accessible to students.**	The evaluation of students is as follows: 1)Written/oral examination(60%). 2)Project(40%).

Activity	*Semester workload*
Lectures	*25*
Project	*25*
Study, preparation	*25*
Course total	*75*

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΚΡΥΣΤΑΛΛΟΔΟΜΗ	ΚΑΒΟΥΝΗΣ Α. ΚΩΝΣΤΑΝΤΙΝΟΣ	ΣΟΦΙΑ ΑΕ

-Συναφή επιστημονικά περιοδικά:Acta Crystallographica,Crystal Engineering Communications Crystal Growth Design, Chemistry of Materials.

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHE 071**	**SEMESTER**	**7**
COURSE TITLE	ENOLOGY I		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background,* *special background, specialised general knowledge, skills development*	Specialized general knowledge, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, level 6 of the European Qualifications Frame work) students will be able to comprehend the basic principles of the following: wine and culture, activities of yeasts and malolactic acid bacteria during winemaking, enzyme activities in must and wine, sulphur dioxide and other additives in must and wine. Chemical composition of must and wine, colloidal phenomena, oxidation-reduction, spoilage of wine. Analysis of must and wine, organoleptic evaluation. Wine and nutrition, positive and negative effects of wine on human health.

Moreover, they will be able to solve problems and exercises related to the subjects of the course, and to correlate chemical composition and activities of microorganisms and enzymes with quality of wine, as well as wine bioactive compounds with human health. They will be able to conduct a literature search using modern technologies.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology. Working independently. Criticism and self-criticism. Production of free, creative and inductive thinking.

(3) SYLLABUS

Wine history. Wine types and categories. Wine in Greece and all over the world. Principles of white and red winemaking as well as of other of winemaking methods. Fermentations and enzyme activities during winemaking. Sulphur dioxide and other additives in wine. Chemical composition of must and wine, colloidal phenomena, oxidation-reduction, spoilage of wine. Analysis of must and wine, organoleptic evaluation. Wine and nutrition, positive and negative effects of wine on human health.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of power point in lectures. Use of ICT technologies in communication with students.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>
<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures, seminars, educational visits</td><td>26</td></tr>
<tr><td>Study and analysis of bibliography, essay writing</td><td>34</td></tr>
<tr><td>Not guided study</td><td>65</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>
<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>
<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>The language of evaluation is Greek. The total evaluation consists of a) written examination (65 %), with open-ended questions, short-answer questions and multiple choice questionnaires, and b) written work, public presentation (35 %).</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ENOLOGY, SCIENCE AND TECHNOLOGY	SOUFLEROS E.	SOUFLEROS E.
ΟΙΝΟΛΟΓΙΑ	TSAKIRIS A.	PSYCHALOS PUBLISHING
ΟΙΝΟΛΟΓΙΑ	*ROUSSIS I.*	*UNIVERSITY OF IOANNINA*

- Related academic journals:
1. American Journal of Enology and Viticulture
2. Australian Journal of Grape and Wine Research
3. Journal International Sciences de la Vigne et du Vin
3. South African Journal of Enology and Viticulture
4. Food Chemistry
5. Journal of Agricultural and Food Chemistry

-Related books:
1. Wine Science, Jackson Ronald,Academic Press 2008.
2. Handbook of Enology Vol.1, Ribereau-Gayon P., Duburdieu D., Doneche B., Lonvaud A., Wiley 2001.
3. Handbook of Enology Vol.2, Ribereau-Gayon P., Glories Y. Maujean A., Duburdieu D., Wiley 2001.
4. Wine Chemistry and Biochemistry, Moreno-Arribas M.V., Polo C., Springer2009
5. Wine Microbiology and Biotechnology, Fleet G.H., CRC Press 1993

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE 507** **7.6.4**	**SEMESTER**	**7th**
COURSE TITLE	**Environmental Geochemistry-Mineralogy**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Consolidate knowledge of chemical concepts in environmental geochemistry-mineralogy.
Provide students with a firm foundation of the application of chemistry onto the natural world
Engender in students a deeper understanding of the earth and our surface environment from a chemical perspective.
The students will:
Be able to describe geochemical data in the context of environmental processes
Demonstrate a basic understanding of what controls the concentration of elements in a range of physical environments
Demonstrate understaning of the most important rock forming minerals, where they are found, their quality and how they are formed
Demonstrate insight to the most important processes that leads to the formation of the different types rocks
Understand the processes that control mineral reactivity and stability under environmentally-relevant conditions.
Understand the earth processes which control the abundance and distribution of minerals at the earth's surface under a range of spatial and temporal scales.
Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies
Promoting free, creative and inductive thinking
Be able to integrate theoretical concepts with their practical applications. Effectively read and critically review scientific literature
Assess rigorously and critically scientific debates and environmental issues

(3) SYLLABUS

Differentiation of and cosmic abundance of elements
Composition of the earth
Geochemistry of igneous rocks, geochemistry of sedimentary rocks, geochemistry of metamorphic rocks
Crystal chemistry –environmental mineralogy- solution-mineral equilibria
The water envelope: oceans
Weathering and soils
Sedimentation and diagenesis

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions,*	

Activity	*Semester workload*
Lectures	48
Written assignment	26
Not guided study	52
Course total	126

open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek, with multiple choice questionnaires and short-answer questions. Written work with public presentation (20%).

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Principles of Environmental Geochemisty. G. Nelson Eby. Thomson-Brooks/Cole, 2004

Introduction to Geochemistry . K.Krauskopf, D. Bird

- Related academic journals:

Applied Geochemistry, Elsevier

Geochimica Cosmochimica Acta , Pergamon press

Geochemistry Exploration Environment Analysis, Lyell collection

COURSE OUTLINE

(1) GENERAL

<table>
<tr><td>SCHOOL</td><td colspan="3">NATURAL SCIENCES</td></tr>
<tr><td>ACADEMIC UNIT</td><td colspan="3">DEPARTMENT OF CHEMISTRY</td></tr>
<tr><td>LEVEL OF STUDIES</td><td colspan="3">Undergraduate</td></tr>
<tr><td>COURSE CODE</td><td>XHE504</td><td>SEMESTER</td><td>7th</td></tr>
<tr><td>COURSE TITLE</td><td colspan="3">ENVIRONMENTAL PROTECTION TECHNOLOGY</td></tr>
<tr><td colspan="2">INDEPENDENT TEACHING ACTIVITIES
<i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i></td><td>WEEKLY TEACHING HOURS</td><td>CREDITS</td></tr>
<tr><td colspan="2">LECTURES</td><td>4</td><td>5</td></tr>
<tr><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td></td><td></td></tr>
<tr><td colspan="2"><i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i></td><td></td><td></td></tr>
<tr><td>COURSE TYPE
<i>general background, special background, specialised general knowledge, skills development</i></td><td colspan="3">Specialized knowledge</td></tr>
<tr><td>PREREQUISITE COURSES:</td><td colspan="3">-</td></tr>
<tr><td>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</td><td colspan="3">GREEK</td></tr>
<tr><td>IS THE COURSE OFFERED TO ERASMUS STUDENTS</td><td colspan="3">YES</td></tr>
<tr><td>COURSE WEBSITE (URL)</td><td colspan="3">-</td></tr>
</table>

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After the successful completion of the course, descriptive level 6 of the European Qualifications Framework for Lifelong Learning, the students will be capable to:

- Understand deeply the principal physical and chemical processes taking place in environmental media and environmental protection technologies, the assessment of basic parameters for taking measures and the application of methods and technologies for pollution control and environmental protection.

Learning outcomes:

- Knowledge and understanding of basic principles and theories related to pollution control and environmental protection technologies.
- Knowledge and understanding of physicochemical processes taking place in environmental media
- Knowledge for applying criteria and measures aiming in pollution control and environmental restoration.
- Knowledge of ecotoxicological concepts and methods of environmental risk

assessments.

Skills:
- Development and application of quality standards, measures and technologies for pollution control and environmental protection.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Application of knowledge dealing with methods, techniques and technologies of pollution control and environmental protection-remediation.
- Inquiring of theoretical and practical background for performing further education, postgraduate and doctoral studies.
- Utilization of laboratory infrastructures and equipment for the above-mentioned aims
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Theoretical knowledge and bringing-applying theory to practice
- Team work as well as working independently
- Working in an international environment
- Working in an interdisciplinary environment
- Production of new research ideas
- Project planning and management
- Respect for the natural environment

(3) SYLLABUS

Introduction to environmental pollution and environmental protection (environmental chains, environmental crisis, measures for environmental protection). Liquid wastes (physical and chemical charecteristics, quality parameters, self-purification of natural water systems). Purification and treatment of natural waters for the production of potable water (legislation and water remediation processes for human consumption, aeration, filtration, sedimentation, ozonation, adsorption, chlorination, UV-radiation). General principles of liquid wastes treatment (purification methods, steps-levels, purification units and efficiency). Primary and preliminary treatment (mechanical pretreatment, screening, sedimentation, coagulation, flocculation, flotation, filtration). Secondary biological treatment (aerobic and anaerobic biological treatments, conventional activated sludge processes, fluidized biological beds). Tertiary chemical treatment (coagulation-flocculation, filtration, clarification, ion exchange, disinfection). Industrial wastes (Characteristics of industrial wastes and examples of treatment-purification units). Solid wastes and treatment methods and technologies (environmental problems, treatment technologies, management of municipal solid wastes, industrial solid wastes). Pollution control of airborne particulate matter (dispersion of suspended particles in air, methods and technologies for suspended matter removal, filtration, cyclones, wet scrubbers, electric precipitators, etc). Technologies for air pollutants control (condensation, absorption, adsorption, incineration, chemical oxidation and neutralization, etc.).

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of Technologies of Information and communications in teaching and communication with students.

TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS

Activity	*Semester workload*
Lectures	52
Written assignment	30
Not guided study	43
Course total	**125**

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek with a combination of open-ended questions, multiple choice questionnaires, short-answer questions and written work with public presentation (20%).

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography (in Greek):
1) Pollution and Environmental Protection Technologies – T. Albanis, Eds. A. Tziola and Sons,
2) I. Konstantinou, T. Albanis, University of Ioannina (Notes)
3) Principles of Antipollution Technologies, Th. Kouimtzis, K. Matis, Eds. Ziti P.
4)

- Suggested bibliography (in English):
1) Handbook of Pollution Prevention Practices / Nicholas P.Cheremisinoff. - New York: Marcel Dekker, Inc., 2001.
2) Water Quality Engineering: Physical / Chemical Treatment Processes, Mark M. Benjamin, Desmond F. Lawler, Wiley (2013).

- Related academic journals:
1) Water Research
2) Environmental Science and Technology

3) Applied Catalysis B:Environmental
4) Journal of Environmental Chemical Engineering
5) Journal of Environmental Management
6) Process Safety and Environmental Protection
7) Waste Management

ΠΕΡΙΓΡΑΜΜΑ ΜΑΘΗΜΑΤΟΣ

1. ΓΕΝΙΚΑ

ΣΧΟΛΗ	Natural Sciences		
ΤΜΗΜΑ	Chemistry		
ΕΠΙΠΕΔΟ ΣΠΟΥΔΩΝ	Undergraduate		
ΚΩΔΙΚΟΣ ΜΑΘΗΜΑΤΟΣ	**3680**	**ΕΞΑΜΗΝΟ ΣΠΟΥΔΩΝ**	7ο
ΤΙΤΛΟΣ ΜΑΘΗΜΑΤΟΣ	General Microbiology		

ΑΥΤΟΤΕΛΕΙΣ ΔΙΔΑΚΤΙΚΕΣ ΔΡΑΣΤΗΡΙΟΤΗΤΕΣ *σε περίπτωση που οι πιστωτικές μονάδες απονέμονται σε διακριτά μέρη του μαθήματος π.χ. Διαλέξεις, Εργαστηριακές Ασκήσεις κ.λπ. Αν οι πιστωτικές μονάδες απονέμονται ενιαία για το σύνολο του μαθήματος αναγράψτε τις εβδομαδιαίες ώρες διδασκαλίας και το σύνολο των πιστωτικών μονάδων*	**ΕΒΔΟΜΑΔΙΑΙΕΣ ΩΡΕΣ ΔΙΔΑΣΚΑΛΙΑΣ**	**ΠΙΣΤΩΤΙΚΕΣ ΜΟΝΑΔΕΣ**
Διαλέξεις	3	3
Ασκήσεις Πράξης		
Προσθέστε σειρές αν χρειαστεί. Η οργάνωση διδασκαλίας και οι διδακτικές μέθοδοι που χρησιμοποιούνται περιγράφονται αναλυτικά στο 4.		

ΤΥΠΟΣ ΜΑΘΗΜΑΤΟΣ *Υποβάθρου , Γενικών Γνώσεων, Επιστημονικής Περιοχής, Ανάπτυξης Δεξιοτήτων*	Core
ΠΡΟΑΠΑΙΤΟΥΜΕΝΑ ΜΑΘΗΜΑΤΑ:	
ΓΛΩΣΣΑ ΔΙΔΑΣΚΑΛΙΑΣ και ΕΞΕΤΑΣΕΩΝ:	Greek
ΤΟ ΜΑΘΗΜΑ ΠΡΟΣΦΕΡΕΤΑΙ ΣΕ ΦΟΙΤΗΤΕΣ ERASMUS	Yes in Englis
ΗΛΕΚΤΡΟΝΙΚΗ ΣΕΛΙΔΑ ΜΑΘΗΜΑΤΟΣ (URL)	Electronic uploading of the courese may be available

2. ΜΑΘΗΣΙΑΚΑ ΑΠΟΤΕΛΕΣΜΑΤΑ

Μαθησιακά Αποτελέσματα

Περιγράφονται τα μαθησιακά αποτελέσματα του μαθήματος οι συγκεκριμένες γνώσεις, δεξιότητες και ικανότητες καταλλήλου επιπέδου που θα αποκτήσουν οι φοιτητές μετά την επιτυχή ολοκλήρωση του μαθήματος.

Συμβουλευτείτε το Παράρτημα Α

- *Περιγραφή του Επιπέδου των Μαθησιακών Αποτελεσμάτων για κάθε ένα κύκλο σπουδών σύμφωνα με Πλαίσιο Προσόντων του Ευρωπαϊκού Χώρου Ανώτατης Εκπαίδευσης*
- *Περιγραφικοί Δείκτες Επιπέδων 6, 7 & 8 του Ευρωπαϊκού Πλαισίου Προσόντων Διά Βίου Μάθησης*

και Παράρτημα Β

- *Περιληπτικός Οδηγός συγγραφής Μαθησιακών Αποτελεσμάτων*

- History of Microbiology, Principles of Koch, classification of microorganisms
- Cell structure morphology and characeristics – Understanding principles
- Nutrition of bacterial cells and growth requirements
- Isolation and characterization of bacterial cells – Methods of determination
- Cell identification and characterization of bacteria
- Μέθοδοι απομόνωσης και ταυτοποίσης βακτηρίων.
- Methods of inactivation and elimination of bacteria – physical and chemical methods of destruction of microorganisms
- Probiotics and bacteria
- An introduction to bacteria and foods

Γενικές Ικανότητες

Λαμβάνοντας υπόψη τις γενικές ικανότητες που πρέπει να έχει αποκτήσει ο πτυχιούχος (όπως αυτές αναγράφονται στο Παράρτημα Διπλώματος και παρατίθενται ακολούθως) σε ποια / ποιες από αυτές αποσκοπεί το μάθημα;.

Αναζήτηση, ανάλυση και σύνθεση δεδομένων και

Σχεδιασμός και διαχείριση έργων

πληροφοριών, με τη χρήση και των απαραίτητων τεχνολογιών
Προσαρμογή σε νέες καταστάσεις
Λήψη αποφάσεων
Αυτόνομη εργασία
Ομαδική εργασία
Εργασία σε διεθνές περιβάλλον
Εργασία σε διεπιστημονικό περιβάλλον
Παράγωγή νέων ερευνητικών ιδεών
Σεβασμός στη διαφορετικότητα και στην πολυπολιτισμικότητα
Σεβασμός στο φυσικό περιβάλλον
Επίδειξη κοινωνικής, επαγγελματικής και ηθικής υπευθυνότητας και ευαισθησίας σε θέματα φύλου
Άσκηση κριτικής και αυτοκριτικής
Προαγωγή της ελεύθερης, δημιουργικής και επαγωγικής σκέψης

- Literature, analysis as well as synthesis of data and information with the aid of technologies.
- Individual or group assessments of students or take home assignments.
- Creative, free and and constructive thinking in modern cases or traditional issues, related to Microbiology, Food Safety and Probiotics.
-

3. ΠΕΡΙΕΧΟΜΕΝΟ ΜΑΘΗΜΑΤΟΣ

The course deals with the general aspects of microorganisms, examining basic cell structure, morphology of the bacterial cell. It also deals with cell nurition requirements, and growth factors, discussing the effects of extrinsic parameters (temperatre, oxygen, light, pH etc.) and their effects on bacterial cell growth. Methods and techniques of elimination of bacteria using physical or chemical means are also described. Finally, an introduction on Probiotics and Foods is given and their relation to bacteria.

4. ΔΙΔΑΚΤΙΚΕΣ και ΜΑΘΗΣΙΑΚΕΣ ΜΕΘΟΔΟΙ - ΑΞΙΟΛΟΓΗΣΗ

<table>
<tr><td>ΤΡΟΠΟΣ ΠΑΡΑΔΟΣΗΣ
<i>Πρόσωπο με πρόσωπο, Εξ αποστάσεως εκπαίδευση κ.λπ.</i></td><td>Class based teaching, person to person interaction.</td></tr>
<tr><td>ΧΡΗΣΗ ΤΕΧΝΟΛΟΓΙΩΝ ΠΛΗΡΟΦΟΡΙΑΣ ΚΑΙ ΕΠΙΚΟΙΝΩΝΙΩΝ
<i>Χρήση Τ.Π.Ε. στη Διδασκαλία, στην Εργαστηριακή Εκπαίδευση, στην Επικοινωνία με τους φοιτητές</i></td><td>Teaching methods will inlvolve literature survey using Internet based search as well scientific data bases. Power point presentation will be presented and discussed in classs. E – class platform methods will also be used as a teaching methods.</td></tr>
<tr><td>ΟΡΓΑΝΩΣΗ ΔΙΔΑΣΚΑΛΙΑΣ
<i>Περιγράφονται αναλυτικά ο τρόπος και μέθοδοι διδασκαλίας.</i>
<i>Διαλέξεις, Σεμινάρια, Εργαστηριακή Άσκηση, Άσκηση Πεδίου, Μελέτη & ανάλυση βιβλιογραφίας, Φροντιστήριο, Πρακτική (Τοποθέτηση), Κλινική Άσκηση, Καλλιτεχνικό Εργαστήριο, Διαδραστική διδασκαλία, Εκπαιδευτικές επισκέψεις, Εκπόνηση μελέτης (project), Συγγραφή εργασίας / εργασιών, Καλλιτεχνική δημιουργία, κ.λπ.</i>

<i>Αναγράφονται οι ώρες μελέτης του φοιτητή για κάθε μαθησιακή δραστηριότητα καθώς και οι ώρες μη καθοδηγούμενης μελέτης ώστε ο συνολικός φόρτος εργασίας σε επίπεδο εξαμήνου να αντιστοιχεί στα standards του ECTS</i></td><td>
<table>
<tr><th><i>Δραστηριότητα</i></th><th><i>Φόρτος Εργασίας Εξαμήνου</i></th></tr>
<tr><td>Lectures uploaded in E-class will include self-assessment questions.</td><td><u>Method of teaching</u>

The methods of teaching will include:

1. Course documents, lectures
2. Interactive teaching
3. Lab practical work
4. In-class assignments and group work
5. Filed trip to the Food Control Authority
6. Take-home assignments
7. Presentations/seminars
8. Videos of effects of food chemistry on food processing</td></tr>
</table>
</td></tr>
</table>

		9. Educational awareness material (pamphlets) **Different teaching methods will assist the student in** 1. Absorbing the course material better 2. Having an interactive environment with their instructor and with their peers 3. Selection of the proper scientific paper, preparation of slides and presentation of the final seminar 4. Use the critical thinking skills for interpretation of results 5. Becoming self-independent 6. Have external experience and hands on skills in the field **<u>Teaching Aids</u>** 1. Lecture provided as power power-point presentations 2. Additional reading and supporting material provided as handouts and uploaded on blackboard 3. Email communication 4. White board for group presentations and discussions 5. Extra reading material available as online resources and textbooks
	Προαιρετικές γραπτές εργασίες επί θέματος	Home assignments on selected literature will be assigned to each student, relevant to the course syllabus.

	σχετικού με το αντικείμενο του μαθήματος. της.	

ΑΞΙΟΛΟΓΗΣΗ ΦΟΙΤΗΤΩΝ *Περιγραφή της διαδικασίας αξιολόγησης* *Γλώσσα Αξιολόγησης, Μέθοδοι αξιολόγησης, Διαμορφωτική ή Συμπερασματική, Δοκιμασία Πολλαπλής Επιλογής, Ερωτήσεις Σύντομης Απάντησης, Ερωτήσεις Ανάπτυξης Δοκιμίων, Επίλυση Προβλημάτων, Γραπτή Εργασία, Έκθεση / Αναφορά, Προφορική Εξέταση, Δημόσια Παρουσίαση, Εργαστηριακή Εργασία, Κλινική Εξέταση Ασθενούς, Καλλιτεχνική Ερμηνεία, Άλλη / Άλλες* *Αναφέρονται ρητά προσδιορισμένα κριτήρια αξιολόγησης και εάν και που είναι προσβάσιμα από τους φοιτητές.*	Language of exam assessment will be Greek for home students or English for Erasmus students. The exam may include: written final exam (100%) with a number of multiple choice questions. There will be a bonus system for the degree of written examination based on the student's performance during the theoretical training, and the grade of the work he may have taken. The criteria of the student bonus system are also posted and continuously available to students through E-class. Erasmus students will be given an oral and written paper on subject related to the course.

5. ΣΥΝΙΣΤΩΜΕΝΗ-ΒΙΒΛΙΟΓΡΑΦΙΑ

-Προτεινόμενη Βιβλιογραφία :

1. General Microbiology (Book)
Efdoxos Publishers. Code Nr: 22677089
First Edition:/2012
Author: Amalia Karagouni
ISBN: 978-960-351-904-1

2.
Food Microbiology (Book) Μικροβιολογία Τροφίμων
STELLA PARIKOU Publishers. Code Nr: 4847
First Edition: 2010
Authors: Montville Thomas J., Matthews Karl R.
ISBN: 978-960-411-713-0

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	CHEMISTRY DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	XHE704	**SEMESTER**	7
COURSE TITLE	LANTHANIDE AND ACTINIDE CHEMISTRY – INTRODUCTION TO NUCLEAR CHEMISTRY		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	5
Laboratory	0	0
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific Area / Special Background / Development Skills
PREREQUISITE COURSES:	NONE
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/enrol/index.php?id=599

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, descriptive marker 6 of the European Qualifications Framework, students should be able to:

- Understand the basic principles of Lanthanides and Actinides Chemistry.
- Understand significant element differences with the other elements of the Periodic Table and be able to predict their chemical behaviour in various chemical environments.

Knowledge

- Knowledge and understanding of the basic concepts, principles and theories related to Lanthanides and Actinides.
- Knowledge of metals metallurgy, their chemistry in the solid state and in solution, their applications and their environmental impact.

Skills

- Skills to solve problems related to the chemistry of these metals.
- Skills to solve problems related to spectroscopic and physicochemical properties of metals.
- Skills in interpreting and / or proposing appropriate synthetic reactions through data analysis.
- Complex problem-solving skills through data analysis of international literature.

Abilities

- Ability to interact with other students or researchers on lanthanides and actinides.
- Ability to work in a team but also independently.
- Ability to work in an international environment.
- Ability to apply their knowledge in dealing with problems related to lanthanide and actinide chemistry.
- Ability to combine bibliographic / experimental data to design products containing lanthanides and actinides.
- Ability to choose and apply relevant methodology to solve a particular problem where an f^n center is involved.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
......
Others...
....

The general competencies that the student should have acquired and to which the course is aimed are:

- Theoretical thinking and ability to translate theory into practice.
- Ability to apply knowledge acquired during the study period and related courses of the curriculum of the Department of Chemistry.
- Ability to search, analyze and synthesize data and information from international literature and use the necessary technologies related to the presentation of research results.
- Acquiring the appropriate theoretical and practical knowledge base to allow further education at the postgraduate level of specialization and doctorate.
- Ability to work together at team level to achieve these goals.

(3) SYLLABUS

Position of lanthanides in the Periodic Table. Historical data . Minerals. Separation and isolation. Lanthanides and their alloys. Stability of Oxidative States. Spectroscopic and magnetic properties. Physical methods for the study of lanthanide complexes. Binary compounds of lanthanides. Lanthanide complex formation constants. Cordination Compounds. Applications. Unusual oxidation steps. Organometallic chemistry of lanthanides. Introduction to Nuclear Chemistry. Actinide production. Oxidative states and electronic structures. Characteristics of actinides. Isolation of metals. Isotope separation methods. Toxicity of Actinides. Nuclear waste treatment. Trends in actinide chemistry. Applications of actinides.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td colspan="2">Classroom</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td colspan="2">e-mail, Powerpoint, Teaching utilizing projects</td></tr>
<tr><td rowspan="4">TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography,</i></td><td><i>Activity</i></td><td><i>Semester workload</i></td></tr>
<tr><td>Lectures</td><td>45</td></tr>
<tr><td>Not guided study</td><td>52</td></tr>
<tr><td>Written assignment</td><td>28</td></tr>
</table>

tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*		
	Course total	***125***
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	The evaluation of the students is done a) by written examination (evaluation) (50%) in Greek which includes: • the description of topics • multiple choise questions • answers to judgement questions • Problem solving. And b) presentation of their written assignment (evaluation) (50%)	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Lanthanide and Actinide Chemistry, Simon Cotton, John Wiley & Sons Ltd, 2006, Chichester
- Rare Earth Coordination Chemistry, C. Huang Ed., John Wiley & Sons Ltd, 2010, Singapore
- Modern Aspects of Rare Earths and Their Chemistry, V. S. Sastri, J.-C. Bünzli, V. Ramachandra Rao, G. V. S. Rayudu, J. R. Perumareddi Eds., Elsevier, 2003, Amsterdam
- Handbook on the Physics and Chemistry of Rare Earths, Vols 1-41, K. A. Gschneidner, Jr., J.-C. G. Bünzli, V. K. Pecharsky, Eds., Elsevier, 2011, Oxford
- Rare Earths, Structure and Bonding, Vol. 22, 1975, Dordrecht
- Binary Rare Earth Oxides, G. Adachi, N. Imanaka, Z.C. Kang Eds., Kluwer Academic Publishers, 2004, Dordrecht
- Extractive Metallurgy of Rare Earths, C.K.Gupta, N.Krishnamurthy, CRC Press, 2005, Boca Raton
- Molecular Catalysis of Rare-Earth Elements, P. W. Roesky Ed., Structure and Bonding, Vol. 137, Series Editor:D. M. P. Mingos, Springer-Verlag, 2010, Dordrecht

- Related academic journals:

ACS: JACS Inorganic Chemistry, Organometallics, Crystal Growth and Design
RSC: Dalton Transactions, CrystEngCom, RSC Advances
Elsevier: Polyhedron, Inorganica Chimica Acta, Inorganic Chemistry Communications, Journal of Solid State Chemistry, Journal of Alloys and Compounds
Wiley: European Journal of Inorganic Chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**7.3.1**	**SEMESTER**	**7**
COURSE TITLE	**Mechanisms in Organic Chemistry**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised General Knowledge
PREREQUISITE COURSES:	Organic Chemistry I, Organic Chemisty II, Organic Chemistry III
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	https://sites.google.com/site/organicchemistryv

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

-

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search for, analysis and synthesis of data, independent working, production of novel research ideas

(3) SYLLABUS

Investigation of mechanisms of organic reactions. Kinetic data and their interpretation. Uses of isotopes (kinetic and not). Study of reactive intermediates. Stereochemical criteria. Structure-activity relationship. Symmetry of Molecular Orbitals. Pericyclic Reactions. Stereochemistry of organic compounds. Molecular models and molecular imaging. Configuration Analysis. Stereoisomerism. Elements of Symmetry Groups. Dynamic Stereochemistry.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td colspan="2">Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td colspan="2">NO</td></tr>
<tr><td rowspan="11">TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><i>Activity</i></td><td><i>Semester workload</i></td></tr>
<tr><td>Lectures</td><td>125</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td colspan="2">Oral examination</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Mechanism and theory in Organic Chemistry των Lowry, T.H και Richardson, K.S.
2. *Advanced Organic Chemistry, 4th ed., part A: Structure and Mechanisms*, Carey, F.A.; Sundberg, R.J. Kluwer Academic/Plenum Publishers.
3. *Principles of General Chemistry*, 2nd ed. Silberberg, M.S., McGraw Hill.
4. *The Investigation of Organic Reactions and their Mechanisms*, Maskill, H.; Blackwell Publishing.
5. *The Physical Basis of Organic Chemistry*, Maskill, H. Oxford Science Publications.
6. *Principles of Chemical Kinetics*, House, J.E.
7. *Advanced Organic Chemistry*, Smith, M.B.; March, J. 5th ed. J. Wiley & sons
8. *Advanced Organic Chemistry, 5th ed., part A: Structure and Mechanisms*, Carey, F.A.; Sundberg, R.J. Kluwer Academic/Plenum Publishers.
9. *Γενική Οργανική Χημεία*, Αλεξάνδρου, Ν.Ε., εκδόσεις Ζητη 1985.

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	Chemistry Department		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	7.2.2	**SEMESTER**	7th
COURSE TITLE	METALLOBIOMOLECULES		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
CLASSROOM	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific area, special background, specialised general knowledge
PREREQUISITE COURSES:	NONE
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

- The aim of the course is to teach and embody basic principles of inorganic biochemistry
- Upon successful completion of the course, students should be able to:

1. Recognize the contribution of bioinorganic chemistry to the development of chemistry and other related disciplines
2. Be able to evaluate the role of metal ions in biological systems.
3. Know the function of metalloporphyrins of hemoglobin in oxygen binding of metal ions.
4. Be aware of the structure and function of metalloenzymes and metalloproteins.
5. Know iron biochemistry
6. Understand the role of metal ions in photosynthesis in Cobalamines B12 and in basic functions of living beings.
7. Know that trace elements are involved in basic functions of the organism.
8. Recognize the applications of metallobiomolecules in organisms growth
9. Be able to evaluate the applications of complexes as metallotherapeutics.
10. Be aware of the applications of the metal ions in toxicology.

Knowledge

Knowledge and understanding of the basic concepts, principles and theories related to the Inorganic

Biological Chemistry-Bioinorganic chemistry, the role of metal ions in biological systems, the structure and function of metalloproteins and metalloenzymes, the role of metal ions in nucleic acids, metalloporphyrins.

Skills

Skills in predicting and assessing the role of metal ions in biological systems both as an external and as an internal factor.

Abilities

Ability to apply the knowledge provided in dealing with problems related to Inorganic Biological Chemistry and Bio-Inorganic Chemistry.

Ability to interpret the type of metal ion binding with biomolecules.

Ability to accurately assess - selects the data provided to solve complex problems.

Ability to work independently and to interact with other students on related subjects

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competencies that the student should have acquired and to which the course is aimed are:

Search, analyze and evaluate data-information and make decisions.

Conversion of theory into practice.

Promote free, creative and inductive thinking.

Autonomous and teamwork as well.

Acquiring the appropriate theoretical background knowledge to enable further education both at a theoretical level (and in a laboratory.

(3) SYLLABUS

1. Metal ions in living organisms

Why certain metals can be found in living organisms and their metabolism.

How do fundamental principles of inorganic chemistry and coordination chemistry apply to understanding the structure and function of metal-containing regions in biological molecules (mainly proteins) and topics related to toxicity and pharmaceutical activity of metal compounds.

The role of metal ions in biological systems, the biological periodic table, essential and non-essential elements.

2. MetalloProtein Function

A. Managing, storing and transporting molecular oxygen (breathing)

B. Transfer of electrons (photosynthesis)

C. Molecular oxygen management - its involvement in enzymes

Metalloproteins, enzymes, non-protein systems, metal transport, metal storage.

3. Anticancer Drugs

Anti-cancer drugs based on platinum and mechanisms of action. Optimization. Metallo-pharmaceuticals, cis-platinum and others, Ru.

4. Nucleic Acid Metal Ion Interaction Chemistry

The toxicity of metal ions also arises from their reactions with nucleic acids.

They interfere with metal-regulatory proteins by blocking gene expression

Synthesis of new anticancer drugs based on cisplatin.

Diagnostic reagents for the structure and function of DNA.

Nature has chosen Fe to bleomycin to target and cause damage to foreign DNA, Zn to Zn-finger proteins to bind to DNA and regulate transcription.

Metal ions and DNA, metallo-genome.

5. Peptide-based metal ion complexes

The importance of metal ions in biological systems is studied:
Proteins - enzymes, Models - peptides, Bioorganic Chemistry
Amino acids, peptides and proteins and their interactions with metalloids.
6. Interactions of Cu (II) and Ni (II) with Histone Peptide Models
Indirect effect of metalloids on DNA and induced toxicity. Hydrolysis of histones and its products as oxidation catalysts for DNA bases.
Histones, histone hydrolysis, oxidation of DNA bases.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	e-mail communication with the students, Power point presentations, Additional notes-exercises websites.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Students are evaluated (in Greek) by presenting to the teaching committee and individual public audience of a project and by final written examination. The exams include questions and problems (multiple choice, short response, problem solving)

Activity	***Semester workload***
Lectures	39
Individual study, preparation	51
Writing a paper to present	35
Course total (25 hours of workload per credit unit)	***125***

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography (first in Greek):

1. Βιοανόργανη χημεία, Δημήτριος Κεσίσογλου, Γεώργιος Ψωμάς Ζήτη, 2011 296 σελ. ISBN 978-960-456-264-0.
2. BIOINORGANIC CHEMISTRY, IVANO BERTINI, HARRY B. GRAY, STEPHEN J. LIPPARD, JOAN SELVERSTONE VALENTINE University Science Books, Mill Valley, California (1994) ISBN 0-935702-57-1
3. «Biological Inorganic Chemistry. An Introduction», Robert R. Crichton, 2008 Elsevier
4. «The Biological Chemistry of the Elements. The Inorganic Chemistry of Life», 2nd Ed., J. J. R. F. da Silva, R. J. P. Williams, 2001, Oxford University Press
5. «Bioinorganic Medicinal Chemistry», E. Alessio Ed., 2011, Wiley VCH.

Additional Material

Metal Ions in Biological Systems, 43 Vol. Set, CRC Press.

-Related Scientific Journals:

Journal of Biological Inorganic Chemistry, Journal of Inorganic Biochemistry, Bioinorganic Chemistry & Applications, Inorganic Chemistry, Dalton Transactions, Inorganica Chimica Acta

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE 305**	**SEMESTER**	**7**
COURSE TITLE	Peptide Chemistry		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, descriptive level 6 of the European Qualifications Framework, students should be able to:

- Understand the basic principles governing Peptide chemistry, in particular amino acid analysis methods, amino acid sequencing, (Peptide bond, secondary structure, tertiary structure, quaternary structure), methods of peptide structure analysis (ORD, CD, NMR, X-ray crystallography) and prediction of the structure of the peptides.

-Peptide synthesis, protection of reactive groups. Methods of peptide bond formation. Undesired reactions during peptide synthesis. Racemization. Synthesis of specific peptides (polyamino acids, sequential polypeptides, cyclic peptides). Solid phase synthesis of peptides. Problems in solid phase peptide synthesis.

- Rational design of model peptides as organocatalysts in assymetric synthesis. Applications in aldol reactions and Mannic reactions. Mechanistic implications.

Knowledge

- Knowledge and understanding of the basic concepts, principles and theories governing Peptide chemistry
- Knowledge and understanding of methods of peptide synthesis and analysis of the structure of peptides.
- Knowledge of the use of international literature.

Skills

- Skills in peptide synthesis and analysis of peptide structure.
- Advanced problem-solving skills through data analysis of international literature.

Abilities

- Ability to apply his / her knowledge in dealing with problems related to Peptide chemistry issues

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Theoretical thinking and ability to translate theory into practice.

- Ability to apply knowledge acquired during the study period and related courses of the curriculum of the Department of Chemistry.
- Ability to search, analyze and synthesize data and information from international bibliography and use the necessary technologies related to the presentation of research results.
- Acquiring the appropriate theoretical and practical knowledge base to allow further education at postgraduate level of specialization and doctorate.
- Working in an interdisciplinary environment.
- Ability to work together at team level to achieve these goals.

(3) SYLLABUS

Introduction. Amino acid analysis. Sequence determination (determination of the N-terminal residue, sequential degradation, sequence determination with mass spectra, fragmentation of peptides). Architectural features of peptides (the peptide bond, secondary structures, tertiary structure, quaternary structure). Methods for the analysis of conformation of peptides (ORD, CD, NMR, X-Ray crystallography). Prediction of conformation in peptides. Peptide synthesis, protection of functional groups. Methods for the formation of the peptide bond. Undesired reactions during peptide synthesis. Racemization. Synthesis of special peptides (Polyamino acids, sequential polypeptides, cyclic peptides). Solid phase peptide synthesis.

Rational design of model peptides as organocatalysts in assymetric synthesis. Applications in aldol reactions and Mannic reactions. Mechanistic implications.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (100%) in Greek, with *open-ended questions and problem solving*

Activity	*Semester workload*
Lectures	52
The student's study hours	73
Course total	**125**

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Peptide Chemistry, M. Bodanszky

- Related academic journals:

Journal of Peptide Science

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	XHE411	**SEMESTER**	7th
COURSE TITLE	Advanced Biochemistry Laboratory		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	6	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=561

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Following the successful completion of the course, the descriptive marker 6 of the European Qualifications Framework, students should be able to:
Understand and apply the basic principles governing biochemical analysis by instrumental analytical techniques.

Knowledge

•Knowledge and correct understanding of the underlying concepts, principles and theories With modern and well-established techniques for studying the biological systems in the field

•Knowledge and understanding of the main parts of the analytical analyzes

Provisions

•Knowledge and understanding of the molecular approaches of molecular biology, Chemistry and Biochemistry

•Knowledge of the use and search of international bibliography

Skills

•Skills in choosing and using the appropriate combination of techniques for study and

solving complex problems of Biochemistry and Molecular Biology
- •Development of analytical methods adapted to the requirements of its uterus of each sample, for the determination of constituents
- •Comprehensive problem-solving skills through international data analysis Bibliography

Abilities

- •Ability to understand bibliographic sources and use the appropriate resources, Methodology based on the infrastructures and available reagents of a biochemical Laboratory
- •Ability to choose and apply the most appropriate experimental conditions to solve a specific problem at the level of routine analysis as well as research level
- •Ability to interact with other students or researchers in chemical matters analysis
- •Ability to work together as well as to the independent way of working
- •Work opportunities in an international environment

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
......
Others...
....

The general skills that the student should have acquired to which the course aims is:
- •Experimental skills and ability to translate theory into practice.
- •Ability to apply knowledge acquired during the period studies and related courses of the Department's Chemistry.
- •Ability to search, analyze and synthesize data and information from international literature and the use of the necessary technologies related to the presentation of research results.
- •Acquiring appropriate experimental and theoretical knowledge background to enable further education at the level postgraduate studies and PhD.
- •Working in an interdisciplinary environment.
- •Ability to collaborate at team level to achieve the above objectives

(3) SYLLABUS

Introduction to cultures of cell lines & Determination of inflammatory markers; Activation of A549 cells with LPS. Separation of A549 cell extract proteins. Detection of phospholipase A_2 (PLA_2) by immunoblotting. Introduction to metabolomics/lipidomics analysis; Hydrolysis of phospholipids by PLA_2 and lipidomic approach using LC-MS. Edman Degradation; Sequence determination of amino acids in peptides and proteins (primary structure). Induction and suppression of yeast α-glycosidase enzyme Saccharomyces cerevisiae. Determination of human ABO blood type from buccal epithelial (cheek) cells and white blood cells found in saliva by PCR: a) DNA isolation, electrophoresis and PCR of the gene that determines the ABO blood group phenotype. b) digestion of these PCR products, electrophoresis, results analysis. Enzymatic kinetics; I. Determination of Km and Vmax of tyrosinase II. Tyrosinase inhibition. Introduction to Flow Cytometry. Determination of Toll Like Receptors (TLRs) in human peripheral blood monocytes by flow cytometry.

(4) TEACHING and LEARNING METHODS – EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.
The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>20</td></tr>
<tr><td>Laboratory Excercise</td><td>55</td></tr>
<tr><td>Written assignment</td><td>25</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Students are assessed on the basis of:
A) performance in the performance and understanding of the experiment during the laboratory exercise on the degree of understanding and assimilation of theoretical knowledge, the control of the laboratory performance and skill required to perform the experiments and includes:
i) short answer questions
ii) answers to questions of theoretical background and judgment
iii) critical assessment of the results
B) Writing individual work that includes recording and interpreting experimental results
C) Oral examination including:
• questions of understanding of each laboratory exercise
• questions to understand the theoretical background and exercise
• Judgement Questions
The final score is as follows:
70% (A + B) + 30% (C)</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ΒΑΣΙΚΕΣ ΑΡΧΕΣ ΚΥΤΤΑΡΙΚΗΣ ΒΙΟΛΟΓΙΑΣ	ALBERTS B., BRAY D., HOPKIN K., JOHNSON A., LEWIS J., RAFF M., ROBERTS K., WALTER P.	BROKEN HILL PUBLISHERS LTD
ΠΡΟΧΩΡΗΜΕΝΟ ΕΡΓΑΣΤΗΡΙΟ ΒΙΟΧΗΜΕΙΑΣ	*ΣΗΜΕΙΩΣΕΙΣ ΤΩΝ ΔΙΔΑΣΚΟΝΤΩΝ (Β΄έκδοση 2016)*	*ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ*

- Related academic journals:

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE504**	**SEMESTER**	**7th**
COURSE TITLE	ENVIRONMENTAL PROTECTION TECHNOLOGY		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
LECTURES	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	-

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After the successful completion of the course, descriptive level 6 of the European Qualifications Framework for Lifelong Learning, the students will be capable to:
• Understand deeply the principal physical and chemical processes taking place in environmental media and environmental protection technologies, the assessment of basic parameters for taking measures and the application of methods and technologies for pollution control and environmental protection.

Learning outcomes:
• Knowledge and understanding of basic principles and theories related to pollution control and environmental protection technologies.
• Knowledge and understanding of physicochemical processes taking place in environmental media
• Knowledge for applying criteria and measures aiming in pollution control and environmental restoration.
• Knowledge of ecotoxicological concepts and methods of environmental risk

assessments.

Skills:

- Development and application of quality standards, measures and technologies for pollution control and environmental protection.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Application of knowledge dealing with methods, techniques and technologies of pollution control and environmental protection-remediation.
- Inquiring of theoretical and practical background for performing further education, postgraduate and doctoral studies.
- Utilization of laboratory infrastructures and equipment for the above-mentioned aims
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Theoretical knowledge and bringing-applying theory to practice
- Team work as well as working independently
- Working in an international environment
- Working in an interdisciplinary environment
- Production of new research ideas
- Project planning and management
- Respect for the natural environment

(3) SYLLABUS

Introduction to environmental pollution and environmental protection (environmental chains, environmental crisis, measures for environmental protection). Liquid wastes (physical and chemical charecteristics, quality parameters, self-purification of natural water systems). Purification and treatment of natural waters for the production of potable water (legislation and water remediation processes for human consumption, aeration, filtration, sedimentation, ozonation, adsorption, chlorination, UV-radiation). General principles of liquid wastes treatment (purification methods, steps-levels, purification units and efficiency). Primary and preliminary treatment (mechanical pretreatment, screening, sedimentation, coagulation, flocculation, flotation, filtration). Secondary biological treatment (aerobic and anaerobic biological treatments, conventional activated sludge processes, fluidized biological beds). Tertiary chemical treatment (coagulation-flocculation, filtration, clarification, ion exchange, disinfection). Industrial wastes (Characteristics of industrial wastes and examples of treatment-purification units). Solid wastes and treatment methods and technologies (environmental problems, treatment technologies, management of municipal solid wastes, industrial solid wastes). Pollution control of airborne particulate matter (dispersion of suspended particles in air, methods and technologies for suspended matter removal, filtration, cyclones, wet scrubbers, electric precipitators, etc). Technologies for air pollutants control (condensation, absorption, adsorption, incineration, chemical oxidation and neutralization, etc.).

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of Technologies of Information and communications in teaching and communication with students.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek with a combination of open-ended questions, multiple choice questionnaires, short-answer questions and written work with public presentation (20%).

Activity	*Semester workload*
Lectures	52
Written assignment	30
Not guided study	43
Course total	**125**

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography (in Greek):

1) Pollution and Environmental Protection Technologies – T. Albanis, Eds. A. Tziola and Sons,
2) I. Konstantinou, T. Albanis, University of Ioannina (Notes)
3) Principles of Antipollution Technologies, Th. Kouimtzis, K. Matis, Eds. Ziti P.
4)

- Suggested bibliography (in English):

1) Handbook of Pollution Prevention Practices / Nicholas P.Cheremisinoff. - New York: Marcel Dekker, Inc., 2001.
2) Water Quality Engineering: Physical / Chemical Treatment Processes, Mark M. Benjamin, Desmond F. Lawler, Wiley (2013).

- Related academic journals:

1) Water Research
2) Environmental Science and Technology

3) Applied Catalysis B:Environmental
4) Journal of Environmental Chemical Engineering
5) Journal of Environmental Management
6) Process Safety and Environmental Protection
7) Waste Management

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE106**	**SEMESTER**	**7th**
COURSE TITLE	**Polymer Science**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on polymer chemistry, classes of polymers and industrial production of polymers. They will also gain knowledge on properties of polymers in solid state and polymer solutions, polymer blends and copolymers. They will learn how to search in literature and analyze data using new technologies. They will also be taught to respect the environment. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Autonomous work
Respect of natural environment
Promoting free, creative and inductive thinking

(3) SYLLABUS

Nomenclature and classification of polymers. Isomerism-stereoisomerism, configurations, conformations. Polymer solubility. Macromolecule dimensions. Molecular weight distribution, average molecular weights and their determination. Solid state properties- amorphous, crystalline state, rubbery state, thermal transitions, mechanical properties. Condensation polymerization and kinetics. Condensation polymers. Chain reaction polymerization - free radical polymerization, cationic polymerization, anionic polymerization and stereoregular polymerization - and kinetics. Polymers made by chain reaction polymerization. Thermosetting polymers. Inorganic polymers. Copolymers. Polymer blends. Polymer networks. Polymer rheology. Polymerization Processes (Bulk Polymerization, Solvent Polymerization, Suspention Polymerization, Emulsion Polymerization, Special Processes).

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below

Activity	***Semester workload***
Lectures	48
Written assignment	24
Not guided study	52
Course total	124

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek, with multiple choice questionnaires and short-answer questions. Written work with public presentation (20%).

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Χημεία πολυμερών Καραγιαννίδης Γεώργιος Π., Σιδερίδου Ειρήνη 2006, Ζήτη Πελαγία & Σια Ο.Ε. ISBN 960-431-991-4

2. Επιστήμη και Τεχνολογία Πολυμερών, Κων/νος Παναγιώτου, εκδόσεις Όλγα Σιμώνη, 2001, ISBN 960-317-055-0

3. Η Επιστήμη των Πολυμερών μέσα από Λυμένες Ασκήσεις, Δημήτρης Σ. Αχιλιάς 2015, Ελληνικά Ακαδημαϊκά Ηλεκτρονικά Συγγράματα και Βοηθήματα www.kallipos.gr, ISBN: 978-960-603-203-5

- Related academic journals:

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE 507 7.6.4**	**SEMESTER**	**7th**
COURSE TITLE	**Environmental Geochemistry-Mineralogy**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Consolidate knowledge of chemical concepts in environmental geochemistry-mineralogy.
Provide students with a firm foundation of the application of chemistry onto the natural world
Engender in students a deeper understanding of the earth and our surface environment from a chemical perspective.
The students will:
Be able to describe geochemical data in the context of environmental processes
Demonstrate a basic understanding of what controls the concentration of elements in a range of physical environments
Demonstrate understaning of the most important rock forming minerals, where they are found, their quality and how they are formed
Demonstrate insight to the most important processes that leads to the formation of the different types rocks
Understand the processes that control mineral reactivity and stability under environmentally-relevant conditions.
Understand the earth processes which control the abundance and distribution of minerals at the earth's surface under a range of spatial and temporal scales.

Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies
Promoting free, creative and inductive thinking
Be able to integrate theoretical concepts with their practical applications. Effectively read and critically review scientific literature
Assess rigorously and critically scientific debates and environmental issues

(3) SYLLABUS

Differentiation of and cosmic abundance of elements
Composition of the earth
Geochemistry of igneous rocks, geochemistry of sedimentary rocks, geochemistry of metamorphic rocks
Crystal chemistry –environmental mineralogy- solution-mineral equilibria
The water envelope: oceans
Weathering and soils
Sedimentation and diagenesis

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>
<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>48</td></tr>
<tr><td>Written assignment</td><td>26</td></tr>
<tr><td>Not guided study</td><td>52</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>126</td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i></td><td></td></tr>
</table>

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek, with multiple choice questionnaires and short-answer questions. Written work with public presentation (20%).

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Principles of Environmental Geochemisty. G. Nelson Eby. Thomson-Brooks/Cole, 2004
Introduction to Geochemistry . K.Krauskopf, D. Bird

- Related academic journals:

Applied Geochemistry, Elsevier
Geochimica Cosmochimica Acta , Pergamon press
Geochemistry Exploration Environment Analysis, Lyell collection

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE		**SEMESTER**	**7th**
COURSE TITLE	**Polymer Chemistry**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on polymer chemistry, classes of polymers and industrial production of polymers. They will also gain knowledge on properties of polymers in solid state and polymer solutions, polymer blends and copolymers. They will learn how to search in literature and analyze data using new technologies. They will also be taught to respect the environment. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Autonomous work
Respect of natural environment
Promoting free, creative and inductive thinking

(3) SYLLABUS

Nomenclature and classification of polymers. Isomerism-stereoisomerism, configurations, conformations. Polymer solubility. Macromolecule dimensions. Molecular weight distribution, average molecular weights and their determination. Solid state properties- amorphous, crystalline state, rubbery state, thermal transitions, mechanical properties. Condensation polymerization and kinetics. Condensation polymers. Chain reaction polymerization - free radical polymerization, cationic polymerization, anionic polymerization and stereoregular polymerization - and kinetics. Polymers made by chain reaction polymerization. Thermosetting polymers. Inorganic polymers. Copolymers. Polymer blends. Polymer networks. Polymer rheology. Polymerization Processes (Bulk Polymerization, Solvent Polymerization, Suspention Polymerization, Emulsion Polymerization, Special Processes).

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>48</td></tr>
<tr><td>Written assignment</td><td>24</td></tr>
<tr><td>Not guided study</td><td>52</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>124</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Written examination (80%) in Greek, with multiple choice questionnaires and short-answer questions.
Written work with public presentation (20%).</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Χημεία πολυμερών Καραγιαννίδης Γεώργιος Π., Σιδερίδου Ειρήνη 2006, Ζήτη Πελαγία & Σια Ο.Ε. ISBN 960-431-991-4

2. Επιστήμη και Τεχνολογία Πολυμερών, Κων/νος Παναγιώτου, εκδόσεις Όλγα Σιμώνη, 2001, ISBN 960-317-055-0

3. Η Επιστήμη των Πολυμερών μέσα από Λυμένες Ασκήσεις, Δημήτρης Σ. Αχιλιάς 2015, Ελληνικά Ακαδημαϊκά Ηλεκτρονικά Συγγράματα και Βοηθήματα www.kallipos.gr, ISBN: 978-960-603-203-5

- Related academic journals:

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE211 (7.1.3)**	**SEMESTER**	**7th**
COURSE TITLE	**Statistical Data Treatment and Quality Control in Chemical Analysis**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background, specialization, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on analytical chemistry topics relevant to chemometrics, quality control and quality assurance. Scientists who wish to design and conduct their experiments properly and extract as much information from the results will obtain such skills and will be benefitted. The course is intended to be of value to the rapidly growing number of students specializing in analytical chemistry, and to those who use analytical methods routinely in everyday laboratory work. Students will develop competences on new 'chemometric' tools and procedures, all of them made practicable by improved computing facilities. The course will give the student a flavour of the potential of these newer statistical methods in practical applications such as environmental, food, pharmaceutical, biological analysis, metabolomics etc. Overall the course will offer substantial understanding of the new chemometric methods and further data interpretation, and will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management* *Respect for difference and multiculturalism*

Adapting to new situations *Decision-making* *Working independently* *Team work* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*	*Respect for the natural environment* *Showing social, professional and ethical responsibility and sensitivity to gender issues* *Criticism and self-criticism* *Production of free, creative and inductive thinking* *……* *Others…* *…….*
Search, analysis and synthesis of data and information, by using the proper technologies Working independently Team work Promoting free, creative and inductive thinking Understanding analytical science, statistics, chemometrcis and demonstrate a coherent understanding of these practises Inquiry and problem solving, critically analyse and solve problems in analytical chemistry, food chemistry, environmental chemistry, pharmaceutical analysis, etc Personal and professional responsibility, be accountable for individual learning and scientific work	

(3) SYLLABUS

Introduction and terminology, Descriptive statistics, Normal (Gaussian) distribution, lognormal distribution, null hypothesis – significance test, identification and rejection of outliers (Q-test), calibration methods, regression analysis, analysis of variance (ANOVA), control charts, interlaboratory testing-Youden plot, uncertainty assessment, introduction to experimental design

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination in Greek, with multiple choice questionnaires and short-answer questions.

Activity	***Semester workload***
Lectures	52
Written assignment	30
Not guided study	43
Course total	125

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography: :

-ΣΤΑΤΙΣΤΙΚΗ ΕΠΕΞΕΡΓΑΣΙΑ ΚΑΙ ΔΙΑΣΦΑΛΙΣΗ ΠΟΙΟΤΗΤΑΣ ΣΤΗ ΧΗΜΙΚΗ ΑΝΑΛΥΣΗ
Κ. ΣΤΑΛΙΚΑΣ, Β. ΣΑΚΚΑΣ, ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)
- Statistics and chemometrics for analytical chemistry, Miller and Miller, 6th edition, Pearson (2010)
- Essential statistics for pharmaceutical sciences, Rowe, Wiley (2007)
- A Practical Guide to Scientific Data Analysis, David J. Livingstone, Wiley (2009)

- Related academic journals:
- Analytical Chemistry
- Journal of Chromatography
- Analytica Chimica Acta
- Journal of Chemometrics

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE 212 (7.1.1)**	**SEMESTER**	**7th**
COURSE TITLE	**Analytical techniques for the characterization of solids and applications**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on analytical techniques for the characterization of solids and applications (Introduction to solid catalysts and surface catalysis. Determination of physical and chemical characteristics of solid catalysts and supports. Zeolitic materials and applications: structure and composition, physical-chemical properties and applications, synthesis-modification, acidity, methods for chemical analysis and characterization of zeolitic materials). They will learn how to search in literature and analyze data using new technologies. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Working independently
Team work
Respect of natural environment
Promoting free, creative and inductive thinking

(3) SYLLABUS

Introduction to solid catalysts and surface catalysis. Determination of physical and chemical characteristics of solid catalysts and supports. Zeolitic materials and applications: structure and composition, physical-chemical properties and applications, synthesis-modification, acidity, methods for chemical analysis and characterization of zeolitic materials.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>50</td></tr>
<tr><td>Written assignment</td><td>25</td></tr>
<tr><td>Not guided study</td><td>50</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Written examination (80%) in Greek, with multiple choice questionnaires and short-answer questions.
Written work with public presentation (20%).</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ΑΝΑΛΥΤΙΚΕΣ ΤΕΧΝΙΚΕΣ ΧΑΡΑΚΤΗΡΙΣΜΟΥ ΣΤΕΡΕΩΝ ΚΑΙ ΕΦΑΡΜΟΓΕΣ	*Α. ΒΛΕΣΣΙΔΗΣ*	*ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)*

1. *Α. Σ. Λυκουργιώτης, Εισαγωγή στην κατάλυση επαφής, επιλογή, σύνθεση και χαρακτηρισμός της υφής των στερεών καταλυτών, Τόμος 1, , εκδόσεις Α. Σταμούλης, 1987.*
2. *D.A. Skoog, F.J. Holler, T.A.Nieman, Principles of Instrumental Analysis, 5th ed, Saunders College Publishing, 1998.*
3. *D.A. Skoog, F.J. Holler, T.A.Niema,(Μεταφραστική ομάδα: Μ.Ι. Καραγιάννης, Κ.Η> Ευσταθίου, Ν. Χανιωτάκης) Αρχές Ενόργανης Ανάλυσης, 5η Έκδοση, Εκδόσεις Κωσταράκης, 2002.*
4. *Jens Weitkamp, Lothar Puppe, Catalysis and Zeolites: Fundamentals and Applications, Springer, 1999.*

5. *L. Smart, E. Moore, Solid State Chemistry-An Introduction, 1st ed, Chapman and Hall, 1992.*

- Related academic journals:

1. *Analytical Chemistry (ACS Publications)*
2. *Studies in Surface Science and Catalysis (Elsevier)*
3. *Industrial & Engineering Chemistry Research (ACS)*
4. *Microporous and Mesoporous Materials (Elsevier)*
5. *Journal of catalysis (Elsevier)*

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE 219 (8.1.2)**	**SEMESTER**	**8th**
COURSE TITLE	**Applied Electrochemistry. Development of Chemical Sensors and Biosensors**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background, specialization, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A
- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on the following topics: Cyclic Voltammetry, Chrono-coulometry and Electrochemical Impedance Spectroscopy. Principle and applications of the most widely used electrochemical methods in the development of chemical sensors and biosensors. Small molecules and Enzyme Immobilization onto electrodes or other platforms. This is the most important step at the construction of a sensor, as (bio)molecules induce specific recognition/catalytic properties. Development of a chemical amperometric sensor. A detailed study. Development of an enzyme amperometric biosensor. Different types of biosensors. Glucose commercial biosensors. Impedimetric sensors and immunosensors. Capacitive and faradic impedimetric (bio)sensors.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism

Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Working independently
Team work
Respect of natural environment
Promoting free, creative and inductive thinking
Understanding analytical science, demonstrate a coherent understanding of analytical chemistry
Depth and breadth of analytical chemistry knowledge
Inquiry and problem solving, critically analyse and solve problems in analytical chemistry
Personal and professional responsibility, be accountable for individual learning and scientific work in analytical chemistry

(3) SYLLABUS

Introduction in electrochemistry. Cyclic Voltammetry, Chrono-coulometry and Electrochemical Impedance Spectroscopy. Principle and applications of the most widely used electrochemical methods in the development of chemical sensors and biosensors. Small molecules and Enzyme Immobilization onto electrodes or other platforms. This is the most important step at the construction of a sensor, as (bio)molecules induce specific recognition/catalytic properties. Development of a chemical amperometric sensor. A detailed study. Development of an enzyme amperometric biosensor. Different types of biosensors. Glucose commercial biosensors. Impedimetric sensors and immunosensors. Capacitive and faradic impedimetric (bio)sensors.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>50</td></tr>
<tr><td>Written assignment</td><td>25</td></tr>
<tr><td>Not guided study</td><td>50</td></tr>
<tr><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Written examination (80%) in Greek.
Written work with public presentation (20%).</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

M.I. Prodromidis “Electrochemical Sensors and Biosensors”, KOSTARAKI, ATHENS 2014 (In Greek)

-**Web sources:**
http://www.news-medical.net/health/What-are-Biosensors.aspx
http://www1.lsbu.ac.uk/water/enztech/biosensors.html
http://www.gwent.org/presentations/biointro.pdf
http://www.powershow.com/view1/224724-ZDc1Z/BIOSENSOR_powerpoint_ppt_presentation

-**Related literature:**

Introduction to Biosensors
Jeong-Yeol Yoon and Lonnie J. Lucas, ISBN13: 9781441960214 (2013)

Biosensors : Properties, Materials and Applications,
Edited by **Rafael Comeaux** , Edited by **Pablo Novotny**, ISBN13: 9781607416173 (2010)

Chemical Sensors : Properties, Performance and Applications
Edited by Ronald V. Harrison, ISBN-13: 978-1607418979 (2013)

Implantable Sensor Systems for Medical Applications
Edited by Andreas Inmann , Edited by Diana Hodgins, ISBN-13: 978-1845699871(2013)

Biosensors Nanotechnology
Edited by Ashutosh Tiwari , Edited by Anthony P. F. Turner, ISBN: 978-1-118-77351-2(2014)

-Journals:
Analytical Chemistry
Sensors and Actuators
Biosensors and Bioelectronics
Lab-on-a-chip

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Chemistry		
LEVEL OF STUDIES	Graduate		
COURSE CODE		**SEMESTER**	7
COURSE TITLE	**CHEMISTRY OF NANOMATERIALS AND APPLICATIONS**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific field / Skill development
PREREQUISITE COURSES:	Knowledge of Physical Chemistry and basic aspects of Inorganic and Organic Chemistry
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (All material in powerpoint is in english)
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After completion of this course, the students should be able to:

- Understand the basic principles of Chemistry and Materials Science in molecular and supramolecular level
- Understand the optical/electrical/structural properties of either organic or inorganic nanostructures
- Understand the basic principles of light-matter interaction and mainly the photophysical/photochemical processes
- Interpret UV-Vis, fluorescence, phosphorescence spectra, excited states of molecular systems and correlate spectral data with energy differences between ground and excited states
- Apply the appropriate photophysical technique in various research related problems.

Knowledge

- Knowledge and understanding of the basic principles and theories which are related with the field of chemistry and materials science.
- Knowledge and understanding of the basic principles and theories which are related with the field of molecular photochemistry.
- Knowledge and understanding of applied spectroscopic techniques, such as UV-Vis, fluorescence, phosphorescence to assess energy parameters in molecular systems.
- Knowledge in utilization of spectroscopic data from international literature.

Skills

- Skills concerning the understanding and elaboration of UV-Vis, fluorescence, phosphorescence spectra.
- Utilization of appropriate spectroscopic method for solving photophysical and photochemical problems
- Complex skills of resolving problems through data analysis of international literature.

Capabilities

- Capability to implement the knowledge to solve problems, which belong to the fields of chemistry and materials science.
- Capability to interact with colleagues or researchers in issues concerning chemistry and materials science.
- Capability to implement the knowledge to solve problems, which belong to the fields of photophysics and photochemistry.
- Capability to interpret the spectral data from UV-Vis, fluorescence, phosphorescence spectra and extract various energy parameters.
- Capability to interact with colleagues or researchers in issues concerning photophysics and photochemistry.
- Capability to choose and apply the most appropriate spectroscopic methods to sole a specific problem
- Capability in team work as well as an individual person.
- Capabilities of working in an international professional envrironment.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general capabilities which should be obtained by the student are:

- Theoretical thinking and the ability to convert the knowledge of theory into calculation of experimental parameters.
- Ability to implement knowledge obtained during study into related lessons taught in the department.
- Ability to search, analyze and synthesize data and information from international literature and utilization of appropriate technologies related to the presentation of research results.
- Obtaining the appropriate practical background of knowledge in order to be able to follow lessons in postgraduate level.
- Work in multidisciplinary environment.
- Ability to collaborate as a team for managing the aforementioned goals.

(3) SYLLABUS

Fullerenes-carbon nanotubes-graphene-inorganic allotropes: Synthesis by bottom up/top down techniques. Chemistry of nanostructured materials. Hybrid nanostructures. Light-matter interaction: excited states and deactivation routes, photochemistry laws. Nonradiative routes of deactivation: internal conversion and intersystem crossing. Radiative routes: fluorescence and phosphorescence. Kinetics: lifetimes and quantum yield. Lasers. Photoinduced energy transfer. Förster mechanism. Dexter mechanism. Triplet–Triplet Annihilation. Quenching of triplet states by oxygen. Photoinduced electron transfer and Marcus theory. Photosynthesis. Examples from recent literature of systems with photochemical interest (compounds of RuII, ReI, IrIII και PtII). Applications: conversion of solar energy, Dye Sensitized Solar Cells, photocatalysis, water splitting. Energy up-conversion and Photodynamic Therapy.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Auditorium</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>➢ Utilization of power point for lectures.
➢ projects.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>
<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>25</td></tr>
<tr><td>Individual projects</td><td>25</td></tr>
<tr><td>Study, preparation</td><td>25</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total <i>(15 work hours per credit unit)</i></td><td><i>75</i></td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i></td><td>The evaluation of students is done by combining:
I. Written/oral final exam (60%) which contains:</td></tr>
</table>

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	○ Problem development ○ Short response questions ○ Critical questions ○ Problem solving. Preparation of personal report (40%)

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
Fundamentals of Photochemistry, K. K. Rohatgi-Mukherjee (1978)

- Related academic journals:
Journal of Physical Chemistry, Advanced Materials, ACS Nano, Journal of American Chemical Society

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE814** **8.6.1**	**SEMESTER**	**8th**
COURSE TITLE	**Valorization of natural resources and energy**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge in issues of Natural Resources, unit operations applied in ore enrichment and metallurgy but mainly on issues of Fossil Fuels, Renewable Energy resources, Green Chemistry and Green Chemical Technology and Sustainability. The students will learn to search in literature and analyze data using new technologies. They will also be taught to respect the environment. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…

……

Search, analysis and synthesis of data and information, by using the proper technologies.
Autonomous work
Respect of natural environment
Promoting free, creative and inductive thinking

(3) SYLLABUS

Natural resources. Ten most important natural resources – water, air, carbon, oil, natural gas, phosphorous, other minerals, iron, soil, forests and timber. Raw materials in chemical industry. Energy in chemical industry. Preparation of ores. Mathematical expressions of ore enrichment. Scrubbing and washing of ores. Heavy media separation method. Magnetic separation. Electrostatic separation. Flotation. Coagulation. Chemical enrichment of ores. Metallic materials. Industrial minerals and rocks. Fossil fuels. Solid fuels, carbon - forms of carbon, reserves, uses. Liquid fuels, oil - chemistry, reserves, extraction, refining, petrochemicals. Gas fuels, natural gas-reserves, extraction, uses. Shale oil. Shale gas. Methane hydrates. Nuclear fuels. Depletion of natural resources. Renewable raw material resources – biomass. Chemicals and fuels from renewable raw materials. Principles of Green Chemistry. Green Chemical Technology-Engineering and Sustainability. Water resources. Renewable energy resources.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek, with multiple choice questionnaires and short-answer questions. Written work with public presentation (20%).

Activity	*Semester workload*
Lectures	48
Written assignment	24
Not guided study	52
Course total	124

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. **Βιομηχανική Οργανική Χημεία,** Δ. Σ. Αχιλιάς, Ι. Ελευθεριάδης, Ν. Νικολαΐδης, 2015, Ελληνικά Ακαδημαϊκά Ηλεκτρονικά Συγγράματα και Βοηθήματα www.kallipos.gr, ISBN: 978-960-603-204-2
2. **Ορυκτός πλούτος της Ελλάδας**, Τσιραμπίδης Ανανίας, εκδόσεις Γιαχούδης & ΣΙΑ Ο.Ε. 2005, ISBN 960-7425-88-X

- Related academic journals:

COURSE OUTLINE

(1) GENERAL

SCHOOL	**School of Science**		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE		**SEMESTER**	8^{o}
COURSE TITLE	Basic Elements of Economics		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Field of Science
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

In the Basic Elements of Economics, is analyzed the way of organizing and operating the markets and the usual business practices. In particular, the subject is analyzed in three sections. The first section concerns financial accounting and financial statement analysis. The second module concerns the introduction of economic theory and analyzes concepts related to microeconomic analysis (demand theory, supply theory, consumer theory, production theory and market models). The third section analyzes agricultural policy, agricultural cooperatives as well as key elements of the European Union.

After the successful completion of the course, the student will be able to:

1. Understand the basic principles of financial accounting
2. Use the basic accounting tools and prepare financial statements
3. Understand consumer and business behavior issues through the application of fundamental economic concepts and laws.
4. Approach and analyze the causes for the creation of demand and supply of economic units and the formation of the market.
5. Analyze in depth the European agricultural policies.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Searching, analysis and synthesis of facts and information, as well as using the necessary technologies
Adaptation to new situations
Decision making
Autonomous (Independent) work
Group work
Excercise of criticism and self-criticism
Promotion of free, creative and inductive thinking

(3) SYLLABUS

I. Introduction to Financial Statement analysis.
II. Need, development, and definition of accounting; Book-keeping and accounting; Persons interested in accounting; Disclosures; Branches of accounting; Objectives of accounting
III. Balance sheet-assets, liabilities.
IV. Accounting transactions
V. Introduction: Incentives, What is Economics?
VI. Specialization and Trade, Production Possibility Frontier (PPF), Comparative Advantage
VII. Markets, Supply and Demand, Elasticity
VIII. Consumers, Producers, and Surplus
IX. Cost of Production to Firms, Cost Curves, Economies of Scale
X. Types of Competition: Perfect Competition, Monopolies, and Oligopolies
XI. Cooperatives
XII. Common Agricultural Policy.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures, face to face
USE OF INFORMATION AND	

<table>
<tr><td>COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td></td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures (3 conduct hours per week x 13 weeks)</td><td>39</td></tr>
<tr><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td></td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Written examination (100%)</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

Χρηματοοικονομική Λογιστική, Γεώργιος Κοντός
Χρηματοοικονομική Λογιστική, Μπαλάς Απόστολος, Χεβάς Δημοσθένης
Μικροοικονομική Μια σύγχρονη προσέγγιση, Varian Hal R
Μικροοικονομική, Besanko David A., Braeutigam Ronald R
Παγκοσμιοποίηση, ΟΝΕ και οικονομική προσαρμογή, Αργείτης Γιώργος

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE 403**	**SEMESTER**	**8**
COURSE TITLE	BIOPOLYMERS		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, descriptive level 6 of the European Qualifications Framework, students should be able to:
Understand the basic principles of Biopolymers, in particular
properties and levels of structures of biological protein macromolecules, Polysaccharides and lipids.

Knowledge
- Knowledge and understanding of the basic concepts, principles and theories governing biopolymers.
- Knowledge and understanding of chemistry and structure of biological macromolecules of proteins, polysaccharides and lipids.
- Knowledge of the use of international literature.

Skills

- Skills solving problems related to Biopolymers.
- Skills solving problems through data analysis of international bibliography.

Abilities

Ability to apply his / her knowledge in dealing with problems related to Biopolymers issues

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Theoretical thinking and ability to translate theory into practice.
• Ability to apply knowledge acquired during the study period and related curriculum subjects of the Department of Chemistry.
• Ability to search, analyze and synthesize data and information from international bibliography and use of the necessary technologies related to the presentation of research results.
• Acquiring the appropriate theoretical and practical knowledge base to allow further education at postgraduate level of specialization and doctorate.
• Working in an interdisciplinary environment. Ability to collaborate at team level to achieve these goals.

(3) SYLLABUS

Introduction to Biophysical Chemistry, levels of structures in biological macromolecules, primary, secondary, tertiary, quaternary structure. Examples of myoglobin, hemoglobin. Key questions related to Biophysical Chemistry, sample quality, structural prediction, stability or flexibility of the structure, differentiation of the properties of the structural components of a macromolecule, how to achieve the natural structure of the biopolymers, Structure / biological activity relationship. Protein structure, amino acid properties, side chain ionization, side chain amino acid polarity. Amino acid composition of proteins, predicting properties of a protein by its amino acid composition, complementary protein components. Primary structure, disulfide bonds and crosslinks, primary structure and analysis of the secondary and tertiary structure, primary structure and prediction of the secondary and tertiary structure, primary structure and function. Secondary structure, β sheet structure and other secondary structures, polyproline and collagen helix , tertiary structure, general structure of the peptide backbone, flexibility and stability of the tertiary structure. Quaternary structure. Other biological polymers, polysaccharides and levels of their structures, polymers composed of different types of macromolecules, polysaccharides with peptides, proteins or lipids in bacterial cell walls, glycoproteins in animal cell membranes. Lipids in biological membranes, lipid components of the membranes, lipid bilayers. Proteins in biological membranes. Conformation analysis and interactions that define the protein structure. Polypeptide chain Geometry, Ramachandran diagrams. Determination of dynamic energy. Interactions involving bond formation, bipolar interactions, internal torsion potential. Formation of hydrogen bonds, competitive role of water in hydrogen bonds of proteins, hydrophobic interactions and water structure. Effect of solvent on protein structure. Free transport energy, interaction of non-polar side chains with water, destruction of hydrophobic interactions with urea. Ionic interactions, physicochemical parameters of ionic interactions. Disulfide bonds, reduction and reoxidation of disulfide bonds. Examples of ribonuclease, proinsulin. Prediction of the protein structure, Chou / Fasman prediction.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (100%) in Greek, with *open-ended questions and problem solving*

Activity	*Semester workload*
Lectures	52
The student's study hours	73
Course total	**125**

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:
BIOPOLYMERS

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE406**	**SEMESTER**	**8th**
COURSE TITLE	**Biotechnology**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization/ skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=866

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, students should be able to:
Understand the basic principles governing Biotechnology such as:

- methods of genetic improvement of micro-organisms for the purpose of their biotechnological exploitation
- the basic principles of biotechnological product production
- ability to recognize how to design the process of producing biotechnology products
- to use the knowledge for suggesting ways to genetically improve micro-organisms for the production of biotechnology products
- ability to formulate judgments that include reflection on scientific or ethical issues related to the cognitive content of biotechnology

Knowledge
• Knowledge and understanding of the basic concepts, principles and theories governing Microbial Biotechnology
Knowledge and understanding of biotechnology applications.

- Knowledge that will imply the ability to critically understand the theories and principles of biotechnology.
- Knowledge of the use of international literature.

Skills
- skills in solving biotechnology problems

Abilities
- Ability to apply his / her knowledge in dealing with problems related to Biochemistry issues

Ability to interact with other biotechnology students or researchers.

Ability to choose and apply the most appropriate methods to solve a specific research problem.
- Promoting free, creative and inductive thinking

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Theoretical thinking and ability to translate theory into practice.
- Ability to apply knowledge acquired during the study period and related courses of the curriculum of the Department of Chemistry.
- Ability to search, analyze and synthesize data and information from international bibliography and use the necessary technologies related to the presentation of research results.
- Acquiring the appropriate theoretical and practical knowledge base to allow further education at postgraduate level of specialization and doctorate.
- Working in an interdisciplinary environment.
- Ability to work together at team level to achieve these goals.

(3) SYLLABUS

Introduction to biotechnology, substrates for cell growth, substrates as carbon and nitrogen sources for biotechnological products.

Mutagenesis, mutants isolation, Molecular and chemical basis of mutagenesis, DNA damaging, kind of mutants, mutagens (chemical, physical), radiations, DNA repair mechanisms. Recombinant DNA technology, lysogenic cycle, bacterial conjugation, transduction, transformation.

Genetic engineering (genetic recombination in vitro, recombinant DNA technology, cloning. Restriction enzymes, vectors, plasmids, cosmids, phages, gene bank, gene cloning, complementary DNA, synthetic DNA). PCR, side directed mutagenesis, protein engineering. Industrial fermentations, microorganisms growth kinetics, industrial bioreactors, sterilization, fermentation process, product isolation. Biotechnological applications.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see workload table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (100%) in Greek, with *open-ended questions and problem solving*

Activity	*Semester workload*
Lectures	52
Educational visits	10
Not guided study	63
Course total	125

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ΒΙΟΤΕΧΝΟΛΟΓΙΑ	ΚΥΡΙΑΚΙΔΗΣ ΔΗΜΗΤΡΙΟΣ Α.	ΖΗΤΗ ΠΕΛΑΓΙΑ ΚΑΙ ΣΙΑ Ο.Ε.
ΕΝΖΥΜΙΚΗ ΒΙΟΤΕΧΝΟΛΟΓΙΑ	ΚΛΩΝΗΣ ΙΩΑΝΝΗΣ	ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ
ΜΟΡΙΑΚΗ ΒΙΟΛΟΓΙΑ ΤΟΥ ΓΟΝΙΔΙΟΥ	JAMES WATSON, TANIA BAKER, STEPHEN BELL, ALEXANDER GANN, MICHAEL LEVINE, RICHARD LOSICK	UTOPIA ΕΚΔΟΣΕΙΣ ΕΠΕ

- Related academic journals:

J. Bacteriology
Applied Microbiology and Biotechnology
Nature Biotechnology
Journal of Biotechnology

COURSE OUTLINE

(1) GENERAL

SCHOOL	Physical Sciences		
ACADEMIC UNIT	Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE804**	**SEMESTER**	**8**
COURSE TITLE	Catalysis by metallic complexes - Mechanisms		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	5
Laboratory	0	0
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	Inorganic Chemistry III
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	-

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After the successful completion of course of Level 6 descriptor, student will be able to:

- Understand the basic principles of the Inorganic Reactions Mechanisms and their relation to basic inorganic reactions.
- Have a deep perception some of the most important catalytic reactions of chemistry and how do these are related to stoichiometric inorganic reactions and at the same time to deeper understand the determining steps.

Knowledge

- Knowledge and understanding of the basic principles, meanings and theories related to inorganic reaction mechanisms.
- Knowledge and understanding of the basic principles and meanings of catalytic reactions with industrial importance.

Skills

- Skills in solving problems related to inorganic reaction mechanisms as well as predicting the molecular structure of reaction products of catalytic processes of industrial interest.
- Skills in solving problems related to intermediate reactions, molecular structures and

oxidation states of catalytic reactions.

- Skills in data analysis in order to explain and/or propose the most probable catalytic cycle taking place.
- Complex skills of solving problems by employing data analysis acquired from literature.

Abilities

- Ability to interact with other students or researchers on topics related to catalytic reaction mechanisms.
- Ability for team work and at the same time autonomous work.
- Ability to work in an international enviroment.
- Ability to employ its knowledge to deal with problems related to catalytic reactions.
- Ability to combine experimental data with those obtained from literature in order to propose a possible reaction mechanism.
- Ability to choose and employ a certain methodology to solve a specific issue of a reaction mechanism related to the metallic center.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general skills acquired by the students after attending the course are the following:

- Theoretical conception and ability to transform this theory to practice.
- Ability to employ the acquired knowledge after completed the course as well as of all the related courses taught in earlier semesters.
- Acquire the most suitable theoretical and practical knowledge background to give the opportunity to attend further training in the framework of postgraduate MSs or even PhD studies.
- Ability to cooperate at a team level in order to achieve the above targets.

(3) SYLLABUS

Classification of the reactions of metallic complexes. Introduction. Depicting catalytic cycles. Classification of homogeneous catalytic reactions. Charge transfer catalytic reactions. Catalytic dissociation of hydrogen peroxide, H_2O_2 (Fenton type reaction - catalase). Organic compounds oxidation by H_2O_2 and various metal cations. Acid - Base catalytic reactions. Amino acids deamination. Hydrolysis of esters. Hydrolysis of phosphoric esters. Alkaline phosphatase. Organic acids decarboxylation. Reactions catalyzed by soft catalysts. CO and H_2 reactions. Gas - water gas. Reductive carbonylation. H_2 reduction of CO. Olefins hydroformylation. Carbonylation reactions. Synthesis of CH_3COOH from MeOH. Adipic acid synthesis. Olefin hydrogenation. π-back bond. Polymerization of ethylene and propylene. Oligomerization. Olefin isomerization. Olefin metathesis. Pd olefin oxidation. Olefin metathesis. Oxidative carbonylation reactions. Oxygen transfer reactions in peroxo- and oxo-species. P450 cytochrome, MMO. Hemocyanine, Tyrosinase. Metalic clusters in catalysis. Nitrogen fixation.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face

<table>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Communication with the students via e-mail
Use of Power Point to support teaching
Teaching with projects assignments</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>28</td></tr>
<tr><td>Personal study and preparation</td><td>52</td></tr>
<tr><td>Writing small personal thesis</td><td>45</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>Students evaluation is performed via:
(i) written final exam (50%) in Greek language comprising:
○ Answering questions
○ Questions with short answers
○ Answering critical thinking questions
○ solving problems

and
(ii) Small thesis oral presentation (50%)</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

Shriver & Atkins, Inorganic Chemistry, 4th Edition	Shriver & Atkins, Inorganic Chemistry, 4th Edition	Shriver & Atkins, Inorganic Chemistry, 4th Edition
Cotton & Wilkinson, Advanced Inorganic Chemistry, 5th Edition	Cotton & Wilkinson, Advanced Inorganic Chemistry, 5th Edition	Cotton & Wilkinson, Advanced Inorganic Chemistry, 5th Edition
Inorganic and Organometallic Reaction Mechanisms 2nd Edition, J. Atwood, 1996		
- "Homogeneous Catalysis – Understanding the Art," 2004 Ed., Piet W.N.M. van Leeuwen, Kluwer Academic Publishers, 2004, ISBN 1402019998.- "Ligand Substitution Processes," C.H. Langford and H.B. Gray, W.A. Benjamin, Inc., 1966 (Online book access at http://caltechbook.library.caltech.edu/100/1/Langford_Lsp.pdf)		
"Catalysis Without Precious Metals," Ed. R. Morris Bullock, Wiley-VCH, 2010 ISBN 9783527323548.- "Principles and Applications of Organotransition Metal Chemistry," Collman,		

Hegedus, Norton, Finke, University Science Press, 1987 ISBN 9780935702514.

"Mechanisms of Inorganic Reactions," Dimitris Katakis and Gilbert Gordon, Wiley-Interscience Publication, 1987 ISBN 0471842583.

-Συναφή επιστημονικά περιοδικά:

ACS: JACS Inorganic Chemistry, Organometallics, ACS Catalysis
RSC: Dalton Transactions
Elsevier: Journal of Organometallic Chemistry, Chemistry Journal of Molecular Catalysis, Applied Catalysis, Catalysis Communications, Journal of Catalysis.
Wiley: European Journal of Inorganic Chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE807**	**SEMESTER**	**H'**
COURSE TITLE	Contemporary spectroscopic methods for the identification of organic molecules		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
LECTURES	3	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge
PREREQUISITE COURSES:	According to the curriculum of the Department of Chemistry there are no prerequisites, but it is not possible to monitor effectively without the required knowledge of Organic Chemistry I and II
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (possibility of teaching in English). All the power point curriculum is in English.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	-

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, level descriptor 6 of the European Qualifications Framework, students should be able to:

• Understand the basic principles of spectroscopy of organic compounds, especially infrared-visible spectroscopy, vibrational spectroscopy, nuclear magnetic resonance and mass spectrometry, and how they can be used for the identification and solution of structures of unknown organic compounds.

• Explain UV-visible, infrared, nuclear magnetic resonance and mass spectra, identify characteristic spectral peaks, evaluate spectral data by identifying and solving structures of organic compounds.

• Choose and apply the appropriate spectroscopic technique or combination of spectroscopic techniques to solve research problems.

Knowledge

• Knowledge and understanding of the basic concepts, principles and theories related to spectroscopy of organic compounds.

• Knowledge and understanding of applications of UV / Vis spectroscopic methods, IR,

NMR and MS in identifying and solving structures of organic compounds.
- Knowledge of the combined use of UV / Vis, IR, NMR and MS techniques in identifying and solving structures of organic compounds.
- Knowledge of the use of spectroscopic data in the international literature.

Skills
- Skills to solve and evaluate UV / Vis, IR, NMR and MS spectra.
- Use of the appropriate spectroscopic method or a combination of methods to solve complex problems of Organic Chemistry.
- Advanced problem solving skills through data analysis of international literature.

Competences
- Ability to apply knowledge in dealing with problems related to spectroscopy of organic compounds.
- Ability to interpret spectral data with the use of one or more techniques and to determine the structure of organic compounds.
- Ability to analyze spectroscopic data and investigate structural and conformational properties of the molecules.
- Ability to interact with other students or researchers in solving spectroscopic problems of organic compounds.
- Ability to select and apply the most appropriate spectroscopic methods and relevant methodology to solve specific research problem.
- Ability to work in a team but also individually.
- Job opportunities in an international environment.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competences are:
- Theoretical thinking and ability to translate theory into practice.
- Ability to apply knowledge acquired during the study period in related courses of the curriculum of the Department of Chemistry.
- Ability to search, analyze and synthesize data and information from international literature and use the necessary technologies related to the presentation of research results.
- Acquiring the appropriate theoretical and practical knowledge to be able to follow further education at postgraduate and doctoral level.
- Working in an interdisciplinary environment.
- Ability to collaborate at a team level.

(3) SYLLABUS

UV-VIS spectroscopy
- Introduction to spectroscopic methods of analysis of organic compounds.
- Electromagnetic radiation
- UV radiation and electronic excitation

- Electronic transitions and selection rules
- Spectra and instrumentation - Beer-Lambert Law
- Chromophoric groups
- Visible spectroscopy
- Exercises - Interpretation of UV-VIS spectra

IR spectroscopy
- Basic concepts of infrared spectroscopy
- Masses, atoms and springs
- Frequency of infrared vibrations of diatomic molecules
- Absorption bands
- Symmetrical vibration, anti-symmetrical vibration, bending vibration
- Simple harmonic oscillator - Non-harmonic oscillator - Factors influencing infrared vibrational frequencies
- Exercises - Interpretation of infrared spectra of a representative number of organic compounds

NMR spectroscopy
- Introduction to NMR spectroscopy - The NMR phenomenon
- Chemical shift
- Characteristic ^{1}H NMR chemical shifts
- Integration of ^{1}H NMR signals
- Spin-spin coupling constants - Analysis of conformation of organic compounds
- Instrumentation – The NMR spectrometer
- ^{13} C NMR spectroscopy
- Fourier Transform NMR Spectroscopy
- Relaxation processes
- NMR time scale - Study of chemical exchange phenomena
- Principles of two-dimensional NMR spectroscopy
- Exercises - interpretation of NMR spectra of a representative number of organic compounds

MS mass spectrometry
- Principles of MS spectrometry
- Ionization energies of valence electrons
- Basic instrumentation of mass spectrometers
- Peaks of molecular ions
- The mass spectrum
- Isotopes
- Ion production methods
- Peaks M + 2 and M + 1
- High resolution mass spectrometry
- Fission fragments
- Exercises - interpretation of MS spectra of a representative number of organic compounds

Combined exercises

- Exercises for combined use of UV / Vis, IR, NMR and MS spectroscopic methods.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to Face

Practical application and demonstration at the NMR Center of the University of Ioannina</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of Technologies of Information and communications in teaching and communication with students.

Teaching with the project method.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>50</td></tr>
<tr><td>Written assignment</td><td>50</td></tr>
<tr><td>Individual study, preparation</td><td>25</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Written examination (80%) in Greek with a combination of open-ended questions, multiple choice questionnaires, short-answer questions and written work with public presentation (20%).

The evaluation of the students is done by written final examination (evaluation) in Greek which includes:
I. Written / oral final examination (60%) comprising:
– the development of topics
– short answer questions
– answers to crisis questions
– a problem solving.

II. Atomic Work Presentation (Concluding Assessment) (40%).</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Proposed Electronic Bibliography:

1. *http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction#IRSpectroscopy*
2. *http://chemwiki.ucdavis.edu/Organic_Chemistry/Organic_Chemistry_With_a_Biological_Emphasis/Chapter_04%3A_Structure_Determination_I/Section_4.3%3A_Ultraviolet_and_visible_spectroscopy*

3. *http://www.slideshare.net/RabbyIstik/uv-spectroscopy-collected?related=2*
4. *http://chemwiki.ucdavis.edu/Organic_Chemistry/Spectroscopy/Infrared_Spectroscopy*
5. *https://www.utdallas.edu/~scortes/ochem/OChem_Lab1/recit_notes/ir_presentation.pdf*
6. *https://drive.google.com/folderview?id=0B3uVX4mPJSC1WFVuWkloUUVyMU0&usp/preview&tid=0B3uVX4mPJSC1Y3hOLWh0VUNBbzA#list*
7. *http://chemwiki.ucdavis.edu/Organic_Chemistry/Spectroscopy/Nuclear_Magnetic_Resonance_Spectroscopy*
8. *http://www.mhhe.com/physsci/chemistry/carey/student/olc/ch13nmr.html*
9. *http://www.chem.ucalgary.ca/courses/350/Carey5th/Ch13/ch13-nmr-1.html*
10. *https://www.youtube.com/watch?v=NuIH9-6Fm6U*
11. *http://chemwiki.ucdavis.edu/Organic_Chemistry/Spectroscopy/Mass_Spectrometry*
12. *https://www.youtube.com/watch?v=tOGM2gOHKPc*
13. *http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/maspec.html#c1*

- Books:

1) Introduction to Spectroscopy, D.L Pavia, G.M. Lampman, G.S. Kriz, J.A. Vyvyan, Brooks/Cole (2008).
2) Spectroscopic Identification of Organic Compounds, 7th Edition, R.M. Silverstein, F.X. Webster, D. Kiemle, Wiley (2005).

- Scientific Journals:

1) Journal of Chemical Education
2) Concepts in Magnetic Resonance
3) Magnetic Resonance in Chemistry
4) Journal of Molecular Structure.

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	8.2.2	**SEMESTER**	**8st**
COURSE TITLE	BIOINORGANIC APPLICATIONS		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
FOR THE WHOLE COURSE	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific area, special background, specialised general knowledge
PREREQUISITE COURSES:	NONE
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The aim of the course is to teach and embody the most common applications in the field of Bioinorganic Chemistry and in the field of Biological Inorganic Chemistry.
Upon successful completion of the course, students should be able to,
1. recognize the contribution of metallobiomolecules in the development of chemistry and other related disciplines,
2. evaluate the applications of metallobiomolecules as metllotherapeutics,
3. recognize and understand the applications of metallobiomolecules as photo-activated drugs,
4. recognize and understand the applications of metallobiomolecules as diagnostics,
5. recognize and understand the applications of metallobiomolecules in toxicology
6. recognize and understand the applications of metallobiomolecules as bio-mimetic catalyst and materials

Knowledge

Knowledge and understanding of the basic concepts, principles and theories related to applied Bioinorganic Chemistry.

Skills

Skills in the relationship of theory-application, in the field of the Bioinorganic Chemistry.

Abilities

Ability to apply the provided knowledge for the development novel Bioinorganic aplications.

Ability to accurately assess - selects the data provided to solve complex problems. Ability to work independently and to interact with other students.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competencies that the student should have acquired and to which the course is aimed are:

Search, analyze and evaluate data-information and make decisions.

Conversion of theory into practice.

Promote free, creative and inductive thinking.

Autonomous and teamwork as well.

Acquiring the appropriate theoretical background knowledge to enable further education both at a theoretical level (in more specific topics of Inorganic Chemistry) and in a laboratory.

(3) SYLLABUS

Introduction to Metal-Based-Drugs (MBD) Metallo-pharmaceutics of Platinum and Palladium in cancer chemotherapy – Synthesis - Mechanism of action. Metallo-pharmaceutics of Au and Sn Synthesis - Mechanism of action. Metallo-pharmaceutics of Iodine. Photo-activated drugs of Ru, Rh and Ir. Metallo-diagnostic agents. Inorganic toxicology. Bio-mimetic catalysts

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	e-mail communication with the students Additional notes-exercises websites.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.*	

Activity	*Semester workload*
Lectures	52
Individual study, preparation	73

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS		
	Course total (25 hours of workload per credit unit)	***125***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Students are evaluated (in Greek) by presenting to the teaching committee and individual public audience of a project and/or by final written examination. The exams include questions and problems (multiple choice, short response, problem solving)

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography (most in Greek):
1. Βιοανόργανη χημεία, Δημήτριος Κεσίσογλου, Γεώργιος Ψωμάς Ζήτη, 2011 296 σελ. ISBN 978-960-456-264-0.
2. BIOINORGANIC CHEMISTRY, IVANO BERTINI University of Florence HARRY B. GRAY California Institute of Technology STEPHEN J. LIPPARD Massachusetts Institute of Technology JOAN SELVERSTONE VALENTINE University of California, Los Angeles University Science Books, Mill Valley, California (1994) ISBN 0-935702-57-1
–Related journals:
Journal of Biological Inorganic Chemistry
Journal of Inorganic Biochemistry
Bioinorganic Chemistry & Applications
Inorganic Chemistry
Dalton Transactions
Inorganica Chimica Acta

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHE 611**	**SEMESTER**	**8**
COURSE TITLE	FOOD BIOCHEMISTRY AND BIOTECHNOLOGY		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general knowledge, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, level 6 of the European Qualifications Frame work) students will be able to comprehend the basic principles of the biochemistry of raw foods, of food indigenous enzymes, of the use of enzymes in food technology, of activities of food indigenous microorganisms, of the use of microorganisms in food technology, health-related properties of food constituents, and of functional foods.
Moreover, they will be able to solve problems and exercises related to the subjects of the course, and to correlate activities of enzymes, microorganisms and bioactive compounds with properties and characteristics of foods.
They will be able to conduct a literature search using modern technologies.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology. Working independently. Criticism and self-criticism. Production of free, creative and inductive thinking.

(3) SYLLABUS

History of enzyme and microbial activities in foods. Biochemistry of raw foods. Food indigenous enzymes. Use of enzymes in food technology. Activities of food indigenous microorganisms. Use of microorganisms in food technology. Health-related properties of food constituents. Functional foods.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of power point in lectures. Use of ICT technologies in communication with students.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	The language of evaluation is Greek. The total evaluation consists of a) written examination (65 %), with open-ended questions, short-answer questions and multiple choice questionnaires, and b) written work, public presentation (35 %).

Activity	***Semester workload***
Lectures, seminars, educational visits	26
Study and analysis of bibliography, essay writing	34
Not guided study	65
Course total	**125**

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

FOOD BIOCHEMISTRY	VAFOPOULOU-MASTROGIANNAKI A.	Ziti Publishing, 2003
FOOD BIOTECHNOLOGY	ROUKAS T.	Giachoudis Publishing 2009
FOOD BIOCHEMISTRY AND BIOTECHNOLOGY	*ROUSSIS I.*	*UNIVERSITY OF IOANNINA (ΣΗΜΕΙΩΣΕΙΣ)*

- Related academic journals:

1. Journal of Food Biochemistry
2. Food Biotechnology
3. Journal of Functional Foods
4. Food Technology and Biotechnology

- Related books:

1. Biochemistry of Foods. Escin Michael NA. Academic Press 2013.
2. Food, Fermentation and Micro-organisms. Bamforth Charles W.Blackwell Publishing 2005
3. Functional Foods. Chadwick , Ruth F. Springer 2003.

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY
LEVEL OF STUDIES	UNDERGRADUATE

COURSE CODE	**XHE 611**	**SEMESTER**	**8**

COURSE TITLE	FOOD BIOCHEMISTRY AND BIOTECHNOLOGY

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general knowledge, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, level 6 of the European Qualifications Frame work) students will be able to comprehend the basic principles of the biochemistry of raw foods, of food indigenous enzymes, of the use of enzymes in food technology, of activities of food indigenous microorganisms, of the use of microorganisms in food technology, health-related properties of food constituents, and of functional foods.

Moreover, they will be able to solve problems and exercises related to the subjects of the course, and to correlate activities of enzymes, microorganisms and bioactive compounds with properties and characteristics of foods.

They will be able to conduct a literature search using modern technologies.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology. Working independently. Criticism and self-criticism. Production of free, creative and inductive thinking.

(3) SYLLABUS

History of enzyme and microbial activities in foods. Biochemistry of raw foods. Food indigenous enzymes. Use of enzymes in food technology. Activities of food indigenous microorganisms. Use of microorganisms in food technology. Health-related properties of food constituents. Functional foods.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of power point in lectures. Use of ICT technologies in communication with students.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see workload table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	The language of evaluation is Greek. The total evaluation consists of a) written examination (65 %), with open-ended questions, short-answer questions and multiple choice questionnaires, and b) written work, public presentation (35 %).

Activity	*Semester workload*
Lectures, seminars	26
Study and analysis of bibliography, essay writing, educational visits	34
Not guided study	65
Course total	**125**

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

FOOD BIOCHEMISTRY	VAFOPOULOU-MASTROGIANNAKI A.	Ziti Publishing, 2003
FOOD BIOTECHNOLOGY	ROUKAS T.	Giachoudis Publishing 2009
FOOD BIOCHEMISTRY AND BIOTECHNOLOGY	*ROUSSIS I.*	*UNIVERSITY OF IOANNINA (ΣΗΜΕΙΩΣΕΙΣ)*

- Related academic journals:

1. Journal of Food Biochemistry
2. Food Biotechnology
3. Journal of Functional Foods
4. Food Technology and Biotechnology

- Related books:

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2. Food, Fermentation and Micro-organisms. Bamforth Charles W.Blackwell Publishing 2005
3. Functional Foods. Chadwick , Ruth F. Springer 2003.

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	XHY 844	**SEMESTER**	8th
COURSE TITLE	MODERN TECHNIQUES OF QUANTUM AND STATISTICAL MECHANICS		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	The Department's curriculum does not require any prerequisite courses. However, the essential attendance and participation in the course lectures presupposes the assimilation of basic mathematical, thermostatistical and quantum-mechanical coursework knowledge taught in the first, second and third years of studies (Calculus I & II, Physical Chemistry I, II and III) of the Chemistry Department.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	http://users.uoi.gr/melissas/notes/lecture%20notes.htm

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*

- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*

- *Guidelines for writing Learning Outcomes*

The course is one of the optional compulsory courses in the direction of Physical and Theoretical Chemistry aiming to theoretically investigate chemical reactions using modern methodologies of quantum and statistical mechanics.

The course material aims at introducing students to the following subjects:
-the understanding of molecular collisions,
-the detailed explanation of molecular collisions,
-using scattering as a mechanism for detecting molecular collisions,
-the perception of the multi-atomic approach of chemical dynamics,
-the application of molecular reaction dynamics to reactions,
- familiarization with molecular energy transfer and
-the emergence of chemical activity through reaction dynamics.

After successful completion of the course, students should be able to:
-realize the importance of time in chemical and physico-chemical phenomena,
-write correctly equations describing the time course of a chemical system,
-propose reaction mechanisms compatible with experimental data,
-understand parameters affecting the speed of chemical reactions,
-accept the coexistence of wave and particle-like nature of particles and electromagnetic radiation,
-establish and solve Schrödinger equation for a series of problems,
-easy to use operators' tools to visualize physical sizes,
-clearly describe simple particle problems in square potential wells,
-easily handle the harmonic oscillator approach and
-solve for the states of hydrogen atom.

Knowledge of:
-what is molecular reaction dynamics,
-why molecular reaction dynamics,
-a simple model of energy partitioning,
-molecular collisions and free-path phenomena,
-dynamics of elastic molecular collisions,
-the reaction cross-section,
-the reaction probability,
-elastic scattering as a probe of the interaction potential,
-intermolecular potentials from experiment and theory,
-angular distribution in direct reactive collisions,
-energy and chemical change,
-three-body potential energy functions and chemical reactions,

-the classical trajectory approach to reaction dynamics,
-from microscopic dynamics to macroscopic kinetics,
-molecules, radiation and laser interactions,
- molecular and ion beam scattering,
-the collisional method,
-quantum reaction dynamics,
-a macroscopic description of energy transfer,
-simple models of energy transfer,
-state-to-state inelastic collisions,
-collisions of molecules with surfaces,
-bimolecular spectroscopy,
-electronic energy transfer,
-collision complexes: their formation and decay (RRKM and Transition State Theory methods),
-multiphoton dissociation,
-Van der Waals molecules and clusters,
-molecular reaction dynamics of gas-surface reactions, and
-stereospecific reaction dynamics.

Skills:
-rapid application of the principles of molecular reaction dynamics in the system under study (particle size, angular distribution of elastic and reactive trajectories, energy and chemical change, application of molecular reaction dynamics, energy transfer collisions),
-skill in the calculation of the energy threshold of the reaction-reactions without energy threshold,
-evaluation of the chemical reaction translational energy requirements,
-the ability to define the dividing surface between reactants and products,
-skill to select the most appropriate potential functions for a proper description of the reaction under study,
-a direct perception of the distribution and consumption of energy in the process of chemical change,
-the ability to study the reaction mechanism using lasers and molecular beams,
-possible application of quantum molecular reaction dynamics methods,
-easy implementation of simple models of energy transfer,
-dealing with state-to-state inelastic collisions,
-ability to study collsions of molecules with surfaces,
-recognition and application of bimolecular spectroscopy methods and
-application of electronic energy transfer.

Abilities:
-ability to understand chemical activity and solve reaction dynamics problems,
-ability to handle unimolecular reaction rates via the RRKM method,
-ability to calculate bimolecular reaction rates with Transition State Theory,
-extension of the Transition State Theory to Variational Transition State Theory and incorporation of tunneling effect calculation,
-ability to measure chemical reactivity of Van der Waals molecules and clusters,
-ability to study adsorption and desorption gas-surface reactions,
-successful treatment of heterogeneous chemical reactivity.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

……

Others…

…….

The course aims students to acquire special knowledge in physical chemistry necessary to cope with the latest developments in chemical science. It also aims to develop critical thinking and familiarization of students with contemporary subjects in the theoretical and experimental fields of science.
In particular, the areas of focus and realization of the above concepts are aimed at developing the following abilities:
-understand chemical reactivity and analyze molecular chemical dynamics problems,
-calculate unimolecular reaction rates with the RRKM method,

-calculate bimolecular reaction rates with Transition State Theory,

-expand Transition State Theory to Variational Transition State Theory and incorporate calculation of tunneling effect,

-include chemical reactivity of Van der Waals complexes,

-compute yields of adsorption and desorption reactions,

-effectively treat gas-surface reactions,

-incorporate heterogeneous chemical reactivity,

-advance collaboration between students to understand each subject and discover ways to cope with,

-search for complementary solutions and evaluate critical thinking for a proper choice between available “tools” and

-plan and deal with a sufficient number of problems to better gain self-reliance and confidence with the "modern" way of thinking.

(3) SYLLABUS

-Definition of molecular reaction dynamics.
-Purposes of molecular reaction dynamics.
-A simple model of energy partitioning.
-Molecular collisions and free-path phenomena.
-Dynamics of elastic molecular collisions.
-The reaction cross-section.
-The reaction probability.
-Elastic scattering as a probe of the interaction potential.
-Intermolecular potentials from experiment and theory.
-Angular distribution in direct reactive collisions.
-Energy and chemical change.
-Three-body potential energy functions and chemical reactions.
-The classical trajectory approach to reaction dynamics.
-From microscopic dynamics to macroscopic kinetics.
-Molecules, radiation and laser interactions.
-Molecular and ion beam scattering.
-The collisional method.
-Quantum reaction dynamics,
-A macroscopic description of energy transfer.
-Simple models of energy transfer.
-State-to-state inelastic collisions.
-Collisions of molecules with surfaces.
-Bimolecular spectroscopy.
-Electronic energy transfer.
-Collision complexes: their formation and decay (RRKM and Transition State Theory methods).
-Multiphoton dissociation.
-Van der Waals molecules and clusters.
-Molecular chemical dynamics of gas-surface reactions, and
-Stereospecific chemical dynamics.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>In class lecturing, encouraging students to participate with comments and questions.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Support of the learning process through a variety of short explanatory video projections and the use of specialized web pages. Fruitful discussions with the audience on selected topics form the literature.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Series of group presentations-discussions for the preparation of the final project defence</td><td>32</td></tr>
<tr><td>Interactive teaching</td><td>10</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Independent Study</td><td>31</td></tr>
<tr><td>Course total</td><td><i>125</i></td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Group presentations-discussions on related topics during semester and presentation of the final project by the end of semester.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

-Related scientific journals: Journal of Chemical Physics, Journal of Physical Chemistry A, B, C, Chemical Physics, Chemical Physics Letters, Journal of the American Chemical Society, Nature Chemistry, Computational and Theoretical Chemistry, Physical Chemistry Chemical Physics, ChemPhysChem.

COURSE OUTLINE

(1) GENERAL

ΣΧΟΛΗ	**SCHOOL OF SCIENCES**		
ΤΜΗΜΑ	**CHEMISTRY**		
ΕΠΙΠΕΔΟ ΣΠΟΥΔΩΝ	**UNDERGRATUATES**		
ΚΩΔΙΚΟΣ ΜΑΘΗΜΑΤΟΣ	**ΧΗΕ 808**	**ΕΞΑΜΗΝΟ ΣΠΟΥΔΩΝ**	**8**
ΤΙΤΛΟΣ ΜΑΘΗΜΑΤΟΣ	**PHOTOCHEMISTRY OF ORGANIC COMPOUNDS AND POLYMERS**		
ΑΥΤΟΤΕΛΕΙΣ ΔΙΔΑΚΤΙΚΕΣ ΔΡΑΣΤΗΡΙΟΤΗΤΕΣ *σε περίπτωση που οι πιστωτικές μονάδες απονέμονται σε διακριτά μέρη του μαθήματος π.χ. Διαλέξεις, Εργαστηριακές Ασκήσεις κ.λπ. Αν οι πιστωτικές μονάδες απονέμονται ενιαία για το σύνολο του μαθήματος αναγράψτε τις εβδομαδιαίες ώρες διδασκαλίας και το σύνολο των πιστωτικών μονάδων*		**HOURS PER WEEK**	**CREDIT POINTS**
LECTURES		4	5
Προσθέστε σειρές αν χρειαστεί. Η οργάνωση διδασκαλίας και οι διδακτικές μέθοδοι που χρησιμοποιούνται περιγράφονται αναλυτικά στο (δ).			
ΤΥΠΟΣ ΜΑΘΗΜΑΤΟΣ *γενικού υποβάθρου, ειδικού υποβάθρου, ειδίκευσης γενικών γνώσεων, ανάπτυξης δεξιοτήτων*	General Background / General Background of Specialized Topics and Skills Development		
ΠΡΟΑΠΑΙΤΟΥΜΕΝΑ ΜΑΘΗΜΑΤΑ:	According to the current curriculum there are no prerequisites; however for an effective attending of the lecture, knowledge of the Organic Chemistry courses I, II and Physical Chemistry II is suggested.		
ΓΛΩΣΣΑ ΔΙΔΑΣΚΑΛΙΑΣ και ΕΞΕΤΑΣΕΩΝ:	GREEK The entire lecture in power point		
ΤΟ ΜΑΘΗΜΑ ΠΡΟΣΦΕΡΕΤΑΙ ΣΕ ΦΟΙΤΗΤΕΣ ERASMUS	YES		
ΗΛΕΚΤΡΟΝΙΚΗ ΣΕΛΙΔΑ ΜΑΘΗΜΑΤΟΣ (URL)			

(2) LEARNING OUTCOMES

Μαθησιακά Αποτελέσματα

Περιγράφονται τα μαθησιακά αποτελέσματα του μαθήματος οι συγκεκριμένες γνώσεις, δεξιότητες και ικανότητες καταλλήλου επιπέδου που θα αποκτήσουν οι φοιτητές μετά την επιτυχή ολοκλήρωση του μαθήματος.

Συμβουλευτείτε το Παράρτημα Α

- *Περιγραφή του Επιπέδου των Μαθησιακών Αποτελεσμάτων για κάθε ένα κύκλο σπουδών σύμφωνα με το Πλαίσιο Προσόντων του Ευρωπαϊκού Χώρου Ανώτατης Εκπαίδευσης*
- *Περιγραφικοί Δείκτες Επιπέδων 6, 7 & 8 του Ευρωπαϊκού Πλαισίου Προσόντων Διά Βίου Μάθησης και το Παράρτημα Β*
- *Περιληπτικός Οδηγός συγγραφής Μαθησιακών Αποτελεσμάτων*

After successful completion of the course, descriptive index 6 of the European Qualifications Framework, students should be able to:

- Understand the principles of quantization as well as the dual nature of light (particle-wave) and its interaction with matter.
- *To understand the relationship between the wavelength of the absorbed radiation and the corresponding energy.*
- *To understand how the interaction light-molecule leads to absorption, emission, and often to photochemical reaction. A prerequisite for this is the understanding of the atomic and molecular orbital description of matter.*
- To understand the nature of the excited states formed, their life time, the variety of their decay pathways and the concept of photonic yield (quantum yield).
- *To get familiarized with a number of basic photochemical reactions and the corresponding interpretations.*
- *To relate the whole theoretical framework with a variety of biological and photochemical processes (photosynthesis, photomimetics, vision, photodynamic therapy, sun protection etc.), as well as with many technological applications (photovoltaics, photoimaging systems, phototreatment of waste and toxic pollutants, green Photochemistry etc.).*
- *To understand the concept of polymers and their characteristics (molecular weights distribution and its determination).*
- *To learn the methods of preparation and characterization.*
- *To understand the concept of the photopolymerization and the properties of the photoinitiators needed for.*
- *To be able to understand the applications of polymers in new technologies (photopolymers, plastic screens, new generation photovoltaics, integrated circuits, etc.).*

Knowledge

- *Knowledge and understanding of basic concepts, principles and theories related to photochemistry and especially those related to the photochemistry of organic compounds.*
- *Knowledge and understanding of basic concepts, principles and theories related to polymerization.*
- *Knowledge and understanding of the applications of spectroscopic methods UV / Vis, fluorescence, laser pulse photolysis.*

Skills

- *Skills in measuring and analyzing spectra UV / Vis, fluorescence, pulse photolysis, gel chromatography.*

Γενικές Ικανότητες

Λαμβάνοντας υπόψη τις γενικές ικανότητες που πρέπει να έχει αποκτήσει ο πτυχιούχος (όπως αυτές αναγράφονται στο Παράρτημα Διπλώματος και παρατίθενται ακολούθως) σε ποια / ποιες από αυτές αποσκοπεί το μάθημα;.

Αναζήτηση, ανάλυση και σύνθεση δεδομένων και	*Σχεδιασμός και διαχείριση έργων*

πληροφοριών, με τη χρήση και των απαραίτητων τεχνολογιών
Προσαρμογή σε νέες καταστάσεις
Λήψη αποφάσεων
Αυτόνομη εργασία
Ομαδική εργασία
Εργασία σε διεθνές περιβάλλον
Εργασία σε διεπιστημονικό περιβάλλον
Παράγωγή νέων ερευνητικών ιδεών

Σεβασμός στη διαφορετικότητα και στην πολυπολιτισμικότητα
Σεβασμός στο φυσικό περιβάλλον
Επίδειξη κοινωνικής, επαγγελματικής και ηθικής υπευθυνότητας και ευαισθησίας σε θέματα φύλου
Άσκηση κριτικής και αυτοκριτικής
Προαγωγή της ελεύθερης, δημιουργικής και επαγωγικής σκέψης
……
Άλλες…
…….

The general skills that should be acquired by the student are:

- *Widening the concept of thermal chemical reaction by its photochemical extension, i.e., the chemistry using light (Photochemistry). Awareness of differences and similarities.*
- *Correlation of the above concept with a host of natural, technological and biological processes.*
- *Awareness of the multitude of applications and technologies arising from the use of light.*
- *Ability of a fruitful correlation of knowledge acquired by core-courses of the Chemistry Department curriculum to Photochemistry.*
- *Ability to search, analyze and evaluate data from the international literature.*
- *Preparation and presentation of a short study that promotes independent work, forces to take decisions, as well as to be creative.*
- *Acquisition of the appropriate theoretical and practical background to allow for further education at the postgraduate and doctoral studies.*
- *Ability to engage in team work in order to achieve the above goals.*

(3) CONTENT OF THE LECTURE

Organic Photochemistry. Introductory concepts of Photochemistry and relation to thermal Chemistry. Electronic structure of organic compounds and interaction with light. Light and absorption. Light and emission. Jablonski Diagram. Kinetics of photochemical processes and photonic efficiency. Elementary photochemical reactions. Applications and perspectives of Photochemistry (photosynthesis, photomimetics, photomedicine and sun protection, conversion and storage of solar energy-Solar Fuels, phototreatment of waste and toxic pollutants, green photochemistry, photochromism, phototherapy, vision, photography, photochemical synthesis, optical information storage, industrial photochemistry, atmospheric photochemistry). Polymers and light. Introduction to polymers. Structure and determination of molecular weights. Photoinitiators for radical and ionic polymerizations and their mechanistic concept. Synthesis and properties of photonic polymers, applications.

(4) TEACHING and LEARNING METHODS - EVALUATION

ΤΡΟΠΟΣ ΠΑΡΑΔΟΣΗΣ *Πρόσωπο με πρόσωπο, Εξ αποστάσεως εκπαίδευση κ.λπ.*	➢ Ex cathedra ➢ Demonstration in the Photochemistry and Polymer Laboratory
ΧΡΗΣΗ ΤΕΧΝΟΛΟΓΙΩΝ ΠΛΗΡΟΦΟΡΙΑΣ ΚΑΙ ΕΠΙΚΟΙΝΩΝΙΩΝ *Χρήση Τ.Π.Ε. στη Διδασκαλία, στην Εργαστηριακή Εκπαίδευση, στην Επικοινωνία με τους φοιτητές*	➢ Support the learning process using power point ➢ Project-base teaching
ΟΡΓΑΝΩΣΗ ΔΙΔΑΣΚΑΛΙΑΣ *Περιγράφονται αναλυτικά ο τρόπος και μέθοδοι διδασκαλίας. Διαλέξεις, Σεμινάρια, Εργαστηριακή Άσκηση, Άσκηση Πεδίου, Μελέτη & ανάλυση βιβλιογραφίας, Φροντιστήριο, Πρακτική (Τοποθέτηση), Κλινική Άσκηση, Καλλιτεχνικό Εργαστήριο, Διαδραστική διδασκαλία, Εκπαιδευτικές επισκέψεις, Εκπόνηση μελέτης (project), Συγγραφή εργασίας / εργασιών, Καλλιτεχνική δημιουργία, κ.λπ.* *Αναγράφονται οι ώρες μελέτης του φοιτητή για κάθε μαθησιακή δραστηριότητα καθώς και οι ώρες μη καθοδηγούμενης μελέτης σύμφωνα με τις αρχές του ECTS*	see table below

Δραστηριότητα	***Φόρτος Εργασίας Εξαμήνου***
Lectures-Seminars	50
Preparation of individual work	40
Preparation for examination	35
Total of the Course	**125**

ΑΞΙΟΛΟΓΗΣΗ ΦΟΙΤΗΤΩΝ *Περιγραφή της διαδικασίας αξιολόγησης* *Γλώσσα Αξιολόγησης, Μέθοδοι αξιολόγησης, Διαμορφωτική ή Συμπερασματική, Δοκιμασία Πολλαπλής Επιλογής, Ερωτήσεις Σύντομης Απάντησης, Ερωτήσεις Ανάπτυξης Δοκιμίων, Επίλυση Προβλημάτων, Γραπτή Εργασία, Έκθεση / Αναφορά, Προφορική Εξέταση, Δημόσια Παρουσίαση, Εργαστηριακή Εργασία, Κλινική Εξέταση Ασθενούς, Καλλιτεχνική Ερμηνεία, Άλλη / Άλλες* *Αναφέρονται ρητά προσδιορισμένα κριτήρια αξιολόγησης και εάν και που είναι προσβάσιμα από τους φοιτητές.*	The student assessment is made by a final examination (evaluation) in Greek, which includes: I. Written / oral final exam that includes ➢ development of some aspects ➢ short-answer questions ➢ answers to critical questions II. Presentation of the written individual work

(5) ΣΥΝΙΣΤΩΜΕΝΗ-ΒΙΒΛΙΟΓΡΑΦΙΑ

-Προτεινόμενη Βιβλιογραφία :

ΣΗΜΕΙΩΣΕΙΣ ΟΡΓΑΝΙΚΗΣ ΦΩΤΟΧΗΜΕΙΑΣ	*ΣΗΜΕΙΩΣΕΙΣ ΔΙΔΑΣΚΟΝΤΑ*	*ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ)*
ΟΡΓΑΝΙΚΗ ΦΩΤΟΧΗΜΕΙΑ	Απόστολος Ι. Μαρούλης	Θεσσαλονίκη 1991
Modern Molecular Photochemistry of Organic Molecules	Nicholas J. Turro, V. Ramamurthy, J.C. Scaiano	University Science Books, 2010

ΧΗΜΕΙΑ ΠΟΛΥΜΕΡΩΝ	Γιώργος Π. Καραγιαννίδης, Ειρήνη Δ. Σιδερίδου	*Εκδόσεις Ζήτη, Θεσσαλονίκη, 2006*

-Συναφή επιστημονικά περιοδικά:

-Photochemistry Photobiology Sciences
-J. Photochemistry and Photobiology
-Macromolecules
-Polymer Chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**8.4.1**	**SEMESTER**	**8th**
COURSE TITLE	**Polymer Science**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on polymer chemistry, classes of polymers and industrial production of polymers. They will also gain knowledge on properties of polymers in solid state and polymer solutions, polymer blends and copolymers. They will learn how to search in literature and analyze data using new technologies. They will also be taught to respect the environment. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Autonomous work
Respect of natural environment
Promoting free, creative and inductive thinking

(3) SYLLABUS

Nomenclature and classification of polymers. Isomerism-stereoisomerism, configurations, conformations. Polymer solubility. Macromolecule dimensions. Molecular weight distribution, average molecular weights and their determination. Solid state properties- amorphous, crystalline state, rubbery state, thermal transitions, mechanical properties. Condensation polymerization and kinetics. Condensation polymers. Chain reaction polymerization - free radical polymerization, cationic polymerization, anionic polymerization and stereoregular polymerization - and kinetics. Polymers made by chain reaction polymerization. Thermosetting polymers. Inorganic polymers. Copolymers. Polymer blends. Polymer networks. Polymer rheology. Polymerization Processes (Bulk Polymerization, Solvent Polymerization, Suspention Polymerization, Emulsion Polymerization, Special Processes).

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek, with multiple choice questionnaires and short-answer questions. Written work with public presentation (20%).

Activity	***Semester workload***
Lectures	48
Written assignment	24
Not guided study	52
Course total	124

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ΕΠΙΣΤΗΜΗ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑ ΠΟΛΥΜΕΡΩΝ, ΚΩΝ/ΝΟΣ ΠΑΝΑΓΙΩΤΟΥ, εκδόσεις Όλγα Σιμώνη, 2001, ISBN 960-317-055-0

- Related academic journals:

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE		**SEMESTER**	**8th**
COURSE TITLE	**Polymeric and Composite Materials**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge materials' technology, polymer classes, polymer composites and nanocomposites' technology. Students will also gain knowledge on polymers with special technological importance and on polymer application in pharmaceutical technology and medicine. They will learn how to search in literature and analyze data using new technologies. They will also be taught to respect the environment. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Autonomous work

Respect of natural environment Promoting free, creative and inductive thinking

(3) SYLLABUS

Introduction to polymers. Polymer classes based on applications. Plastics. Thermoplastics, polyolefins, chlorinated polymers, styrene polymers, vinyl polymers with side groups, thermoplastic polyesters, polyamides, polyethers, polysulfones, thermoplastic polyimides, cellulose esters. Thermosetting polymers, crosslinked polyesters, polyurethanes, epoxy resins, formaldehyde resins, allyl resins, bismaleimides, thermosetting polymethacrylate resins. Elastomers, introduction, types of elastomers, tires. Textile and industrial fibers, introduction, general properties of fibers, natural fibers, manmade fibers, modified natural polymers, synthetic fibers, other fibers. Coatings. Adhesives. Polymer additives, foaming agents, reinforcing agents, flame retardants, plasticizers, fillers, hardeners, stabilizers, coupling agents, impact modifiers, colorants. Industrial production of synthetic polymers. Polymer processing. Copolymers. Polymer blends. Polymer networks. Liquid crystalline polymers, conductive polymers, photonic polymers, polymers from renewable resources, naturally occurring polymers, biodegradable polymers, polymers for medical and pharmaceutical applications, hydrogels. Composite materials, classification based on matrix. Polymer matrix composites. Production of polymer matrix composites, reinforcement by fibrous, laminar and granular reinforcing agents. Properties and applications of polymer matrix composites. Polymer matrix nanocomposites. Applications of polymers in concrete technology.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	See workload table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek, with multiple choice questionnaires and short-answer questions. Written work with public presentation (20%).

Activity	*Semester workload*
Lectures	48
Written assignment	24
Not guided study	52
Course total	124

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ΤΕΧΝΟΛΟΓΙΑ ΠΟΛΥΜΕΡΩΝ Καραγιαννίδης Γεώργιος Π., Σιδερίδου Ειρήνη Δ., Μπικιάρης Δημήτρης Ν., Αχιλιάς Δημήτρης Σ. εκδόσεις ΖΗΤΗ ΠΕΛΑΓΙΑ ΚΑΙ ΣΙΑ Ο.Ε. 2009, ISBN 960-456-145-6

ΕΠΙΣΤΗΜΗ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑ ΠΟΛΥΜΕΡΩΝ, ΚΩΝ/ΝΟΣ ΠΑΝΑΓΙΩΤΟΥ, εκδόσεις Όλγα Σιμώνη, 2001, ISBN 960-317-055-0

- Related academic journals:

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	CHEMISTRY DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE		**SEMESTER**	
COURSE TITLE	GRADUATION PROJECT I and II		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
winder semester (Graduation project I)	5	5
spring semester (Graduation project II)	10	10
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	special background, specialised general knowledge, skills development
PREREQUISITE COURSES:	NONE
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	NONE

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

- The aim of the course is to practice students in bibliographic research methods, to design and execute experiments or theoretical calculations to investigate or solve a chemical problem, evaluate the results and rationalize their written and oral presentation. Finally, it aims to transmit and cultivate love for research.
- After completing the course students should:

1. Be aware of the use of databases to find appropriate bibliography for a specific research object.
2. Be able to understand the results of published scientific papers related to their project.
3. Have been trained in experimental techniques (synthesis, spectroscopic characterization etc) or methods of theoretical calculations, depending on the subject of their project.
4. Be able to design some new experiments or calculations with knowledge of the bibliography of the particular research object.
5. Understand the theoretical background of their dissertation work.
6. Be able to produce understandable and clear research results in writing.
7. Be able to make an oral presentation of research results to a satisfactory degree.
8. Understand to a considerable extent the importance of research for the development of chemistry as a science and its importance for practical applications

9. Have developed interest in contemporary research topics.
10. Have critical thinking about research problems.
11. Have a first contact with the whole process of research concerning literature knowledge, design of experiments or calculations, their realization, use of corresponding techniques, interpretation of results, draw conclusions, design of new experiments or calculations based on previous results, written presentation of results, oral presentation of the results to the public.

Knowledge

Knowledge and understanding of the basic concepts, principles and theories related to the project work and the research process in general (search bibliography, design-execution of experiments or calculations, evaluation of results, written and oral presentation of results).

Skills

Skills in synthetic methods or theoretical calculations, use of instruments, interpretation of experimental results, written and oral presentation of research results.
Advanced problem solving skills through careful analysis of the provided data.

Abilities

Ability to apply the knowledge provided to address issues related to research topics in various fields of Chemistry
Ability to apply modern experimental techniques or calculations.
Ability to interpret experimental data.
Ability to create an integrated scientific text in a specific field of knowledge with conclusions based on the literature and the experiment
Ability to write and present results.
Ability to work independently and to interact with other students on subject matter

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competencies that the student should have acquired and to which the course is aimed are:
Search, analyze and synthesize data and information and make decisions.
Conversion of theory into practice.
Promote free, creative and inductive thinking.
Autonomous but also teamwork.
Acquiring the appropriate theoretical knowledge base to enable further education both at a theoretical level (in more specific topics of Inorganic Chemistry) and in a laboratory.

(3) SYLLABUS

The graduation project I and II includes the completion of the experimental process in the 7th and 8th semesters and the completion of the relevant scientific work which will include (a) introduction, (b) discussion of results, (c) conclusions, (d) experimental part, (e) bibliography. This work will be titled "Graduation Project"

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Electronic communication with students

TEACHING METHODS

The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS

Activity	***Semester workload***	
	winter GP I	***spring GP II***
Literature search and study	25	50
Experimental work	50	100
Not guided study	50	100
Course total	***125***	***250***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	After the completion of the graduation project (GP) and the correction of the original text by the supervising professor, it is printed in its final form. Copy of GP is submitted to the Secretariat of the Department in electronic form. The Secretariat grants the supervising lecturer a scorecard in which he scores separately (on the 0-10 score scale) the following evaluation points: • Quality of content and written text of GP • Quality of oral presentation • Knowledge in the specific subject of the GP and bibliographic information on the subject • Knowledge in the wider subject of the subject of the GP • Consistency of work and good laboratory practice during the elaboration of the GP The form is completed, signed and returned to the Secretariat of the Department. The average score of all individual points for each student, rounded to the nearest unit, is the grade of the GP. Which is recorded in the analytical score of each student.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**8.6.1**	**SEMESTER**	**8th**
COURSE TITLE	**Valorization of natural resources**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge in issues of Natural Resources, unit operations applied in ore enrichment and metallurgy but mainly on issues of Fossil Fuels, Renewable Energy resources, Green Chemistry and Green Chemical Technology and Sustainability. The students will learn to search in literature and analyze data using new technologies. They will also be taught to respect the environment. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Autonomous work
Respect of natural environment
Promoting free, creative and inductive thinking

(3) SYLLABUS

Natural resources. Ten most important natural resources – water, air, carbon, oil, natural gas, phosphorous, other minerals, iron, soil, forests and timber. Raw materials in chemical industry. Energy in chemical industry. Preparation of ores. Mathematical expressions of ore enrichment. Scrubbing and washing of ores. Heavy media separation method. Magnetic separation. Electrostatic separation. Flotation. Coagulation. Chemical enrichment of ores. Metallic materials. Industrial minerals and rocks. Fossil fuels. Solid fuels, carbon - forms of carbon, reserves, uses. Liquid fuels, oil - chemistry, reserves, extraction, refining, petrochemicals. Gas fuels, natural gas-reserves, extraction, uses. Shale oil. Shale gas. Methane hydrates. Nuclear fuels. Depletion of natural resources. Renewable raw material resources – biomass. Chemicals and fuels from renewable raw materials. Principles of Green Chemistry. Green Chemical Technology-Engineering and Sustainability. Water resources. Renewable energy resources.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>48</td></tr>
<tr><td>Written assignment</td><td>24</td></tr>
<tr><td>Not guided study</td><td>52</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>124</td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Written examination (80%) in Greek, with multiple choice questionnaires and short-answer questions.
Written work with public presentation (20%).</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

ΟΡΥΚΤΟΣ ΠΛΟΥΤΟΣ ΤΗΣ ΕΛΛΑΔΑΣ ΤΣΙΡΑΜΠΙΔΗΣ ΑΝΑΝΙΑΣ Σ. εκδόσεις Γιαχούδης & ΣΙΑ Ο.Ε. 2005, ISBN 960-7425-88-X

- Related academic journals:

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE 719** **8.6.4**	**SEMESTER**	**8th**
COURSE TITLE	**Environmental Geochemistry-Mineralogy**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Consolidate knowledge of chemical concepts in environmental geochemistry-mineralogy.
Provide students with a firm foundation of the application of chemistry onto the natural world
Engender in students a deeper understanding of the earth and our surface environment from a chemical perspective.
The students will:
Be able to describe geochemical data in the context of environmental processes
Demonstrate a basic understanding of what controls the concentration of elements in a range of physical environments
Demonstrate understaning of the most important rock forming minerals, where they are found, their quality and how they are formed
Demonstrate insight to the most important processes that leads to the formation of the different types rocks
Understand the processes that control mineral reactivity and stability under environmentally-relevant conditions.
Understand the earth processes which control the abundance and distribution of minerals at the earth's surface under a range of spatial and temporal scales.
Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences *Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?* *Search for, analysis and synthesis of data and information, with the use of the necessary technology* *Adapting to new situations* *Decision-making* *Working independently* *Team work* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas* *Project planning and management* *Respect for difference and multiculturalism* *Respect for the natural environment* *Showing social, professional and ethical responsibility and sensitivity to gender issues* *Criticism and self-criticism* *Production of free, creative and inductive thinking* *……* *Others…* *…….*
Search, analysis and synthesis of data and information, by using the proper technologies Promoting free, creative and inductive thinking Be able to integrate theoretical concepts with their practical applications. Effectively read and critically review scientific literature Assess rigorously and critically scientific debates and environmental issues

(3) SYLLABUS

Differentiation of and cosmic abundance of elements
Composition of the earth
Geochemistry of igneous rocks, geochemistry of sedimentary rocks, geochemistry of metamorphic rocks
Crystal chemistry –environmental mineralogy- solution-mineral equilibria
The water envelope: oceans
Weathering and soils
Sedimentation and diagenesis

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions,*	

Activity	***Semester workload***
Lectures	48
Written assignment	26
Not guided study	52
Course total	126

open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek, with multiple choice questionnaires and short-answer questions. Written work with public presentation (20%).

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Principles of Environmental Geochemisty. G. Nelson Eby. Thomson-Brooks/Cole, 2004
Introduction to Geochemistry . K.Krauskopf, D. Bird

- Related academic journals:

Applied Geochemistry, Elsevier
Geochimica Cosmochimica Acta , Pergamon press
Geochemistry Exploration Environment Analysis, Lyell collection

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Chemistry		
LEVEL OF STUDIES	Graduate		
COURSE CODE	**XHE 809**	**SEMESTER**	**8**
COURSE TITLE	**MOLECULAR MATERIALS**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific field / Skill development
PREREQUISITE COURSES:	Basic knowledge of Physical, Inorganic and Organic Chemistry
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (All material in powerpoint is in english)
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After completion of this course, the students should be able to:

- Understand the basic principles of materials science in molecular and supramolecular level
- Interpret XRD spectra in crystalline and amorphous materials, calculate structural parameters and correlate the data with the structure of atoms in three dimensions
- Understand optical/electrical/structural properties of various chemical systems (inorganic/organic).

Knowledge

- Knowledge and understanding of the basic principles and theories which are related with the fields of materials chemistry and science.
- Knowledge and understanding of applied spectroscopic techniques, such as XRD.
- Knowledge in utilization of spectroscopic data from international literature.

Skills

- Skills concerning the understanding and elaboration of XRD spectra.
- Complex skills of resolving problems through data analysis of international literature.

Capabilities

- Capability to implement the knowledge to solve problems, which belong to the fields of materials chemistry and science.
- Capability to interpret the spectral data from XRD and extract various structural parameters.
- Capability to interact with colleagues or researchers in issues concerning materials chemistry and science.
- Capability in team work as well as an individual person.

Capabilities of working in an international professional envrironment.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

……

Others…

…….

The general capabilities which should be obtained by the student are:

- Theoretical thinking and the ability to convert the knowledge of theory into calculation of experimental parameters.
- Ability to implement knowledge obtained during study into related lessons taught in the department.
- Ability to search, analyze and synthesize data and information from international literature and utilization of appropriate technologies related to the presentation of research results.
- Obtaining the appropriate practical background of knowledge in order to be able to follow lessons in postgraduate level.
- Work in multidisciplinary environment.
- Ability to collaborate as a team for managing the aforementioned goals.

(3) SYLLABUS

Intermolecular forces in molecular solids. Synthesis and growt of crystals. Characterization methods for molecular solids. Impurities and defects in crystals. Molecular motions in crystal lattice. Chemical reactions in molecular crystals. Optical properties of molecular crystals. Electrical properties of molecular crystals.

Fullerenes-carbon nanotubes-graphene. Materials with nonlinear optical properties. Molecular porous materials. Co-crystals and pharmaceutical solids.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY
Face-to-face, Distance learning, etc.

Auditorium – Exhibition to the XRD instrumentation

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students

- ➢ Utilization of power point for lectures.
- ➢ projects.

TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS

Activity	*Semester workload*
Lectures	25
Individual projects	25
Study, preparation	25
Course total ***(15 work hours per credit unit)***	***75***

STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.

The evaluation of students is done by combining:

I. Written/oral final exam (60%) which contains:
   - ○ Problem development
   - ○ Short response questions
   - ○ Critical questions
   - ○ Problem solving.

Preparation of personal report (40%)

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:
Advanced Materials, ACS Nano, Journal of American Chemical Society

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE 209 (8.1.3)**	**SEMESTER**	**8th**
COURSE TITLE	**Environmental Chemistry**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
LECTURES	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on Environmental chemistry, will be introduced to the principles and factual basis of chemistry in an environmental context, will gain an appreciation of the scientific methodology in environmental chemistry, and will develop problem-solving and critical-thinking skills that are necessary to analyse and discuss chemical and physical phenomena in the environment.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

This Course aims to promote:

- free, creative and inductive thinking
- understanding science, demonstrate a coherent understanding of environmental science
- scientific knowledge, exhibit depth and breadth of environmental science knowledge
- inquiry and problem solving, critically analyse and solve problems in environmental science
- communication, be an effective communicator of environmental science
- personal and professional responsibility, be accountable for individual learning and scientific work in environmental science

(3) SYLLABUS

Introduction to Environmental Chemistry, Chemistry Fundamentals (Chemical Equilibrium, Acid-Base Reactions, Redox Processes, Complexes and Complex Formation, Chemical Kinetics, Photochemical Processes, Radiochemistry), The Chemistry of Natural Environmental Processes, The Chemistry of Processes in the Atmosphere, The Chemistry of Processes in the Lithosphere, The Chemistry of Processes in the Hydrosphere, Natural Biochemical Processes and Organisms in the Biosphere, Effects of Pollutants on the Chemistry of the Atmosphere, Hydrosphere, and Lithosphere, Effects of Pollutants on the Biosphere: Biodegradability, Toxicity, and Risks, Physicochemical and Physical Treatment of Pollutants and Wastes, Biological Treatment of Pollutants and Wastes, The Minimization and Prevention of Pollution; Green Chemistry.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Study and analysis of bibliography</td><td>30</td></tr>
<tr><td>Not guided study</td><td>43</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination,</i></td><td>Written examination with multiple choice questionnaires and short-answer questions and essay/report (100%) in Greek.</td></tr>
</table>

public presentation, laboratory work, clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1) Environmental Chemistry Fundamentals. J.G. Ibanez, M. Hemandez-Esparza, C. Doria-Serrano, A. Fregoso-Infante, M. Mohan Singh, Springer Science-Business Med ia, LLC (2007).
2) Principles of Environmental Chemistry, R. M. Harrison, RSC Publishing, 2007
3) An Introduction to Environmental Chemistry 2nd Edition, J.E. Andrews, P. Brimblecombe, T.D. Jickells, P.S. Liss and B. Reid, Blackwell Publishing, 2004
4) Environmental Chemistry, S. E. Manahan, 7th Edition, Lweis Publishers, 2000

- Related academic journals:

1) Journal of Chemical Education (American Chemical Society)
2) Environmental Science and Technology (American Chemical Society)
3) The Science of the Total Environment (Elsevier)
4) Environmental Pollution (Elsevier)

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE 219 (8.1.2)**	**SEMESTER**	**8th**
COURSE TITLE	**Applied Electrochemistry. Development of Chemical Sensors and Biosensors**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background, specialization, skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge on the following topics: Cyclic Voltammetry, Chrono-coulometry and Electrochemical Impedance Spectroscopy. Principle and applications of the most widely used electrochemical methods in the development of chemical sensors and biosensors. Small molecules and Enzyme Immobilization onto electrodes or other platforms. This is the most important step at the construction of a sensor, as (bio)molecules induce specific recognition/catalytic properties. Development of a chemical amperometric sensor. A detailed study. Development of an enzyme amperometric biosensor. Different types of biosensors. Glucose commercial biosensors. Impedimetric sensors and immunosensors. Capacitive and faradic impedimetric (bio)sensors.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism

Working in an international environment *Working in an interdisciplinary environment* *Production of new research ideas*	*Production of free, creative and inductive thinking* *……* *Others…* *…….*
Search, analysis and synthesis of data and information, by using the proper technologies. Working independently Team work Respect of natural environment Promoting free, creative and inductive thinking Understanding analytical science, demonstrate a coherent understanding of analytical chemistry Depth and breadth of analytical chemistry knowledge Inquiry and problem solving, critically analyse and solve problems in analytical chemistry Personal and professional responsibility, be accountable for individual learning and scientific work in analytical chemistry	

(3) SYLLABUS

Introduction in electrochemistry. Cyclic Voltammetry, Chrono-coulometry and Electrochemical Impedance Spectroscopy. Principle and applications of the most widely used electrochemical methods in the development of chemical sensors and biosensors. Small molecules and Enzyme Immobilization onto electrodes or other platforms. This is the most important step at the construction of a sensor, as (bio)molecules induce specific recognition/catalytic properties. Development of a chemical amperometric sensor. A detailed study. Development of an enzyme amperometric biosensor. Different types of biosensors. Glucose commercial biosensors. Impedimetric sensors and immunosensors. Capacitive and faradic impedimetric (bio)sensors.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek. Written work with public presentation (20%).

Activity	*Semester workload*
Lectures	50
Written assignment	25
Not guided study	50
Course total	125

(5) ATTACHED BIBLIOGRAPHY

M.I. Prodromidis "Electrochemical Sensors and Biosensors", KOSTARAKI, ATHENS 2014 (In Greek)

-**Web sources:**
http://www.news-medical.net/health/What-are-Biosensors.aspx
http://www1.lsbu.ac.uk/water/enztech/biosensors.html
http://www.gwent.org/presentations/biointro.pdf
http://www.powershow.com/view1/224724-ZDc1Z/BIOSENSOR_powerpoint_ppt_presentation

-**Related literature:**

Introduction to Biosensors
Jeong-Yeol Yoon and Lonnie J. Lucas, ISBN13: 9781441960214 (2013)

Biosensors : Properties, Materials and Applications,
Edited by **Rafael Comeaux** , Edited by **Pablo Novotny**, ISBN13: 9781607416173 (2010)

Chemical Sensors : Properties, Performance and Applications
Edited by Ronald V. Harrison, ISBN-13: 978-1607418979 (2013)

Implantable Sensor Systems for Medical Applications
Edited by Andreas Inmann , Edited by Diana Hodgins, ISBN-13: 978-1845699871(2013)

Biosensors Nanotechnology
Edited by Ashutosh Tiwari , Edited by Anthony P. F. Turner, ISBN: 978-1-118-77351-2(2014)

-Journals:
Analytical Chemistry
Sensors and Actuators
Biosensors and Bioelectronics
Lab-on-a-chip

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**8.6.1**	**SEMESTER**	**8th**
COURSE TITLE	**Food Industries & product development**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	3	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of the course, level 6 of the European Qualifications Framework, students will be able to understand the basic principles of the following: milk technology, meat products, bread and related products, fruit and vegetable products, oils and fats, alcoholic beverages and alkaloid effervescent, soft drinks, and other foods.

Preparation of food products from non-conventional sources, as well as using new processes and technologies. Innovation & Entrepreneurship, the need to develop new food products, research to develop new products, new product development process, innovative foods, business plans, successful case studies

Students will be able to solve problems and exercises related to the topics of the course. In addition, they will be able to search the literature using modern technologies.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues

Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Autonomous work
Practice criticism and self-criticism.
Promoting free, creative and inductive thinking

(3) SYLLABUS

Technology of preparation of dairy products, meat products, bread and related products, products of fruits and vegetables, oils and fats, alcoholic and alkaloid soft drinks, and other foods. Food industry waste management.
Preparation of food products from non-conventional sources, as well as using new processes and technologies.
Innovation & Entrepreneurship, the need to develop new food products, research to develop new products, new product development process, innovative foods, business plans, successful case studies

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>56</td></tr>
<tr><td>Study and analysis related literature</td><td>24</td></tr>
<tr><td>Not guided study</td><td>45</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>Written examination (70%) in Greek, with either multiple choice questionnaires and or answer questions.
Written work submitted (30%).</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
1. «ΤΕΧΝΟΛΟΓΙΕΣ ΕΠΕΞΕΡΓΑΣΙΑΣ ΚΑΙ ΣΥΣΚΕΥΑΣΙΑΣ ΤΡΟΦΙΜΩΝ»
Αρβανιτογιάννης Ι., Στράτακος Α.
UNIVERSITY STUDIO PRESS A.E.
ISBN: 978-960-12-2016-1
Κωδικός ΕΥΔΟΞΟΥ: 12560794
2. «ΕΡΕΥΝΑ ΚΑΙ ΑΝΑΠΤΥΞΗ ΝΕΩΝ ΠΡΟΪΟΝΤΩΝ & ΕΠΙΧΕΙΡΗΜΑΤΙΚΩΝ ΣΧΕΔΙΩΝ»

Σφλώμος Κ., Βαρζάκας Θ.
ΕΚΔΟΣΕΙΣ ΤΣΟΤΡΑΣ
ISBN: 978-618-5309-70-1
Κωδικός ΕΥΔΟΞΟΥ: 77271644

- Related academic journals:

1. **Nutrition and Food Science**, Emerald
2. **Trends in Food Science and Technology**, Elsevier
3. **Food reviews international**, Taylor & Francis
4. **British food journal**, Emerald
5. **Journal of food engineering**, Elsevier
6. **European Journal of Innovation Management**, Emerald Insight
7. **Creativity and Innovation Management**, Wiley Online Library
8. **Journal of Product Innovation Management**, Wiley Online Library
9. **Technovation,** Elsevier,
10. **European journal of innovation management**, Emerald

COURSE OUTLINE

1. GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	*Undergraduate*		
COURSE CODE	XHY 202	**SEMESTER**	2nd
COURSE TITLE	Mathematics II		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	5
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (4).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	General background
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	N/A

2. LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described. Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The course is related to Mathematical Analysis. Students, upon successful completion of the course will be familiar with the concepts of:

1. Indefinite integrals and its methods of computation
2. Definite integrals and the Riemann definition of integrals
3. Mean value theorem
4. Integration and its applications, identifying and solving differential equations of various types
5. Complex numbers and their applications in practical problems
6. Vectors and their algebra. Applications in various geometrical problems.
7. Matrices, determinants and their application in solving linear systems of equations
8. Multi-variable functions and partial derivatives

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
Others

Production of new research ideas
The course promotes inductive, analytical and creative thinking. It aims to provide the first-year student with the theoretical background and practical thinking to handle concepts of Mathematical Analysis.

3. SYLLABUS

Indefinite integral, definition of definite integrals, integration methods, differential equations, applications of integrals in practical problems, complex numbers and their applications in practical problems, matrices, determinants and their usage in solving linear systems of equations, vector calculus and its usage in geometrically representing practical problems, multi-variable functions and the concept of partial derivative

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	ICT is used. (slide show etc.) and blackboard in Teaching. The communication with the students and the distribution of the educational material, mainly through an appropriate platform (announcements, lecture slides and other educational material, posting and submitting assignments, user groups, discussions, electronic messages, exercises, glossary, multimedia), but also conventional e-mail. Laboratory for computer handling and practice through practical exercises in the subjects of the course. Extracting information and scientific data from the internet.
TEACHING METHODS *The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically defined evaluation criteria are given, and if and where they are accessible to students.*	I. Written final exam (Mandatory) II. Exercises as homework (Optional)

Δραστηριότητα	***Φόρτος Εργασίας Εξαμήνου***
Lectures	52
Study the theory and solve exercises	73
Course total	***125***

5. SUGGESTED BIBLIOGRAPHY

Μαθηματικά Ι β΄ έκδοση, εκδόσεις Τσότρας ISBN: 978-618-506676-5

Μαθηματικά ΙΙ β’ έκδοση, εκδόσεις Τσότρας ISBN: 978-618-5066-77-2

Απειροστικός Λογισμός Τόμος Α, Ντούγιας Σωτήρης, Έκδοση: 3/2007, ISBN: 9789607901668, LIBERAL BOOKS ΜΟΝΟΠΡΟΣΩΠΗ ΕΠΕ

Απειροστικός Λογισμός, ΤΟΜΟΣ Ι, Νεγρεπόντης Στυλιανός,Γιωτόπουλος Σ. Χ.,Γιαννακούλιας Ευστάθιος, Έκδοση: 1η έκδ./1999, ISBN: 9789602660201, Σ.ΑΘΑΝΑΣΟΠΟΥΛΟΣ & ΣΙΑ Ι.Κ.Ε

ΔΙΑΦΟΡΙΚΟΣ ΚΑΙ ΟΛΟΚΛΗΡΩΤΙΚΟΣ ΛΟΓΙΣΜΟΣ, SPIVAK MICHAEL, Έκδοση: 2Η/2010, ISBN: 9789605243029, ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ

ΜΑΘΗΜΑΤΙΚΑ ΓΙΑ ΕΠΙΣΤΗΜΟΝΕΣ ΚΑΙ ΜΗΧΑΝΙΚΟΥΣ - ΤΟΜΟΣ 1,LOTHAR PAPULA, Έκδοση: 14η Γερμανική/2020, ISBN: 9789606450976, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ

THOMAS ΑΠΕΙΡΟΣΤΙΚΟΣ ΛΟΓΙΣΜΟΣ, George B. Thomas, Jr., Joel Hass, Christopher Heil, Maurice D. Weir, Έκδοση: 1η/2018, ISBN: 9789605245153, ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ

Απειροστικός λογισμός, Briggs William, Cochran Lyle, Gillett Bernard, Έκδοση: 1η έκδ./2018, ISBN: 9789605862343, ΕΚΔΟΣΕΙΣ ΚΡΙΤΙΚΗ ΑΕ

Λογισμός Συναρτήσεων μιας Μεταβλητής και Γραμμική Άλγεβρα, 2η Έκδοση, Μυλωνάς Νικόλαος, Σχοινάς Χρήστος, Παπασχοινόπουλος Γ., ISBN: 9789604186631, ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHY071**	**SEMESTER**	
COURSE TITLE	**Chemical processes of Chemical Technology**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific area / special background / skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://www.chem.uoi.gr

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After the successful completion of the course, descriptive level 6, 7 of the European Qualifications Framework for Lifelong Learning, the students will be capable to: After successfully completing the course, descriptive marker 6 of the European Qualifications Framework, students should be able to:

- Understand the basic principles of chemical engineering methods for their industrial use.
- recognize how to design the process of manufacturing industrial products.
- formulate judgments that include reflection on scientific or ethical issues related to the cognitive content of industrial chemistry.

Knowledge

- Knowledge and understanding of the basic concepts of reaction kinetics and chemical engineering principles.
- Knowledge and understanding of the applications of chemical engineering.
- Knowledge that implies the ability to critically understand the theories and principles of chemical engineering.

Skills

- Has skills to solve problems related to chemical engineering.

Abilities

- Ability to apply his / her knowledge to address problems related to chemical engineering.

- Ability to interact with other students or researchers in chemical engineering.
- Ability to choose and apply the most appropriate methods to solve a specific research problem.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competences that the student should have acquired and to which the course is aimed are:

- Theoretical thinking and ability to apply the knowledge gained during the course "Chemical Processes of Chemical Technology" as well as related courses of the Chemistry Department curriculum
- Ability to search, analyze and synthesize data and information from international bibliography and use the necessary presentation technologies, research results.
- Acquiring the appropriate theoretical knowledge base to allow further education at postgraduate level of specialization and doctorate.
- Working in an interdisciplinary environment.

Ability to collaborate at team level to achieve these goals.

(3) SYLLABUS

The Chemical Industry: raw materials and basic products of the chemical industry, introduction to the chemical processes and chemical reactors. Basics of chemical thermodynamics and chemical equilibrium. Mass and energy balances. Homogeneous chemical reactions kinetics. Enzymatic reactions kinetics. Chemical reactors. Batch reactors. Semi-batch reactors. Continuous Stirred Tank Reactors (CSTR). Plug-Flow reactors. Experimental determination of the rate of chemical reaction. Differential and integral method for the analysis of the kinetic data of chemical reactions. Operation of chemical reactors under isothermal conditions. Chemical reactors in series and optimization of chemical reactors. Principles of adsorption, adsorbent materials, IUPAC adsorption isotherm models, study of Langmuir, Temkin, Freudlich and BET isotherm models. Catalysis theories, kinetics of heterogeneous catalytic reactions. Heterogeneous catalytic reactors. Mass and heat transfer in heterogeneous catalytic processes. Heterogeneous non-catalytic processes. Heterogeneous non-catalytic reactors. Biochemical processes. Enzyme Fermentation, Microbial Fermentation. Biochemical reactors. Non ideal flow in chemical reactors.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of Technologies of Information and communications in teaching and communication with students.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Written assignment</td><td>10</td></tr>
<tr><td>Not guided study</td><td>63</td></tr>
<tr><td></td><td></td></tr>
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</table>

directed study according to the principles of the ECTS		
	Course total	125

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	The evaluation of the students is done by written final examination (evaluation) in Greek which includes: Written / oral final examination including: • open-ended questions • short answer questions • problem solving. Presentation of Personal Work

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography (in Greek):

ΧΗΜΙΚΕΣ ΔΙΕΡΓΑΣΙΕΣ ΤΗΣ ΧΗΜΙΚΗΣ ΤΕΧΝΟΛΟΓΙΑΣ, ΣΔΟΥΚΟΣ Α. Θ., ΠΟΜΩΝΗΣ Φ. Ι., ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Ο.Ε., 2010, 978-960-418-221-3.

ΜΗΧΑΝΙΚΗ ΧΗΜΙΚΩΝ ΔΙΕΡΓΑΣΙΩΝ, LEVENSPIEL, ΕΚΔΟΣΕΙΣ ΕΥΡΙΔΙΚΗ ΚΩΣΤΑΡΑΚΗ, 2011, 978-960-87655-8-0.

- Related academic journals:

Όλα τα περιοδικά χημικής μηχανικής

Chemical Engineering journal

Industrial and engineering chemistry research

Journal of catalysis

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE054**	**SEMESTER**	**3rd**
COURSE TITLE	History and Philosophy of Natural Sciences		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised knowledge, skills development
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	-

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of the course, European Descriptive Indicator 6 of the European Qualifications Framework, students should be able to know that:

• natural sciences and especially the science of chemistry is not the production and constitution of its theories by individual genius scientists who operate super-historically, i.e. outside. from the place and time of their production, but it is the story of the people who tried to investigate and understand the function and structure of nature.

• Science is a social practice that meets in the various periods of its evolution, in the formation of the specific Paradigm or state of science, a series of social, ideological, empirical and terminological processes characterized by their historicity.

• The philosophy of science is a special subject with its own concepts, methods and theories.

• The object, focuses on the particularities of chemistry and other natural sciences, and it requires the encounter of philosophy with chemistry and in addition a deep understanding of the history of chemistry and natural sciences.

• Thus, the philosophy of sciences is nothing more than the reconstruction of the history of the past of the sciences, which is its retrospective history from the perspective of the present status of science.

• The relationship between chemistry and physics, the well-known demand of reductionism, as well as the other molecular sciences e.g. biology.

Issues of the philosophy of science are logic, ontology, methodology, language, philosophy of technology, philosophy of nature and literature, ethics and aesthetics. Thus, students should acquire the ability to formulate judgments that involve reflection on philosophical, scientific, aesthetic or ethical issues related to the cognitive content of the science of chemistry.

The following emerge as important issues:

1. Changes in the constitution of the sciences, changes in the paradigm, are not the result of cumulative processes but of discontinuous processes of change of perspective.
2. The evolution of science is not a linear but it is a process that encounters theoretical and experimental obstacles which must be overcome.
3. The relationship between experiment and theory, rationality-empiricism in physics and chemistry.
4. The role of the scientific laboratory and the cooperation of its various actors (scientific and technical personnel).
5. The role of experimental devices and their limits.

Skills

The skills, as they emerge from the philosophy of chemistry and natural sciences in general, and are required from the practice of the natural sciences, relate to: thinking and doing, measuring, representing and reflecting.

Abilities

Ability to apply of the student the knowledge to the treatment of problems related to issues of philosophy of natural sciences. Ability to interact with other students is researched in epistemology. Ability to select and apply concepts and theories, historically evolving from the science of chemistry and philosophy to solve a specific research problem.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

• Ability to interact comparative and productive thinking during the development of all chemistry and natural sciences' subjects. More specifically, on the concepts of the various objects of natural sciences, the concept of experiment, laws, models, explanations, natural species, (chemical) substance, chemical representation and classification, the elaboration of competing theories, the role of instruments, the distinction between science and technology, the autonomy of chemistry.

• Ability to search, analyze and synthesize data and information from the literature for the formation of the philosophical themes of natural sciences, as well as the perspective and problems encountered by modern science.

• Acquisition of the appropriate theoretical knowledge background, so that further training at postgraduate level.

• Ability to collaborate at team level to achieve the above targets.

(3) SYLLABUS

The aim of the course is to familiarize students with the following issues: What is what we call science. What is what we call scientific change. Logical constructivism (logic as a philosopher's stone). Logical individualism, empiricism and unity of science. Verification, cognitive meaning, induction and hypothesis. Theories about science as structures, epistemological obstacle theory (Bachelard). Theory of the Paradigm (Kuhn). Methodology of scientific research programs (Lakatos). Feyerabend: anarchism and everything is allowed. Bachelard: non-Cartesian epistemology and rejection of realism. Non-Cartesian epistemology and scientific objectivity. The structure of a scientific field. Objective knowledge. Subject-object. Objectivity and non-Cartesian subject. The Epistemology of the Revolutions between Realism and Instrumentalism (Causality and Objectivity – Rational Structure, Rational Activity and Forms of Experience – Distance from Kant. Objectivity and conditions of the possibility of experience. Constitution of Science, Science as Social Practice. The Powerful Program in the Sociology of Knowledge (Edinburgh School). Mental content and social approach to meaning Political constitution and social management of events. Towards an Anthropology of Science: Social Constructivism. About the material. The philosophical category of matter. The scientific category of the material. Quantum chemistry. Quantum mechanics as the basis of chemical applications Robert Sanderson Mulliken (molecular orbitals). Gilbert Newton Lewis: the common pair of electrons. Linus Pauling, From the Search for Strength Theory to the Integration of Coordination Theory: 'The Chemical Bond' Epistemological Issues. The conceptual 'definition' of Physics and Chemistry. Chemical symbolism. The approach of the Chemical Revolution from historiographical strategies. Chemistry as a discontinuity of alchemy The French epistemological school.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-face.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of Power point for laboratory courses.
Communication with graduate students via email and video conference.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
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<tr><td></td><td>125</td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>The evaluation of students is done through a written final exam (evaluation) in Greek which includes:
Written/oral final exam including:
• Theme development
• Short Answer Questions
• Answers to crisis questions
•Problem solving.
Presentation of Individual Work</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Philosophy of Chemistry, Jaap van Brakel, Leuven University Press, second edition 2013
- Φιλοσοφία και επιστήμες-Από τον Πλάτωνα μέχρι τον Καντ, Ε. Μπόκαρης, Εκδ. ΟΥΤΟΠΙΑ, 2020
- Μπασελάρ-Επιστήμες και Αντικειμενικότητα, Mary Tiles, Παν/κές Εκδ. Κρήτης

-Συναφή επιστημονικά περιοδικά:

Science HYLE: International Journal for Philosophy of Chemistry, Foundations of Chemistry
Journal of General Philosophy of Science
British Journal for the Philosophy of Science
Journal of Chemical Education
Annals of Science

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHE501**	**SEMESTER**	**7th**
COURSE TITLE	**Inorganic Chemical Technology**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge in issues of sustainability, circular economy and bioeconomy, green chemical technology, basic Unit Operations and Chemical Processes, technologies to produce Basic Inorganic Chemicals. The students will learn to search in literature and analyze data using new technologies. They will also be taught to respect the environment. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Autonomous work
Respect of natural environment
Promoting free, creative and inductive thinking

(3) SYLLABUS

Basic processes in chemical industry. Raw materials in chemical industry. Energy in chemical industry (energy resources, rational use of energy, storage of energy). Sustainability, Chemistry in Circular Economy and Bioeconomy. 4th Industrial Revolution, Green Engineering, Prevention, Renewable Raw Materials, Byproducts and Wastes as Raw materials, Control of Energy and Mass Flows, Process Intensification, Biomimetics in Processes.

Industrial production of nitrogen and oxygen. Production of hydrogen. Electrolytic decomposition of water. Reforming of CH4 (thermodynamic equilibrium, catalysts, mechanism, kinetics, formation of carbon, production unit). Production of ammonia (thermodynamic equilibrium, catalysts, mechanism, kinetics, production units, reactor). Production of nitric acid (thermodynamic equilibrium, catalysts, mechanism, kinetics, reactor, production of dilute HN03 in low pressure unit, production of dilute HN03 in high pressure unit, production of dense HN03). Production of sulfuric acid. Sulfuric acid and its economical significance. Production of S02 (production of S02 by sulfur combustion, production of S02 by pyrites combustion). Oxidation of S02 (thermodynamic equilibrium, catalysts, mechanism, kinetics, reactor). Production unit. Condensation of dilute solutions of H2S04. Industries using sodium chloride as raw material. Sodium chloride. Soda production. Production of Cl2, NaOH και HCI. Electrochemical processes, yield of electric current and energy. Electrolysis of aquatic solutions of NaCI-production of NaOH, Cl2, H2. Production of hydrochloric acid. (Electrolysis of NaCI melt, production of metallic sodium). Inorganic fertilizers. Phosphate fertilizers (Raw materials of phosphorous, apatite, phosphorite, phosphorous properties and production, production of H3P04 with the thermal method, production of H3P04 with dissolution of phosphorites, polyphosphoric acids and polyphosphates, production of simple perphosphoric acid, double phosphoric, sedimentation phosphoric, CaHP04. 2H20, thermophosphates, sintering phosphates and provenders, utilization of fluoride from phosphates). Nitrogen fertilizers, [ammonium nitrate, carbamide (urea), calcium cyanamide, ammonium sulfate, sodium nitrate, calcium nitrate]. Potassium fertilizers: production of KCI from sylvinite, production of K2S04). Complex fertilizers. Mixed fertilizers. Trace elements (microfertilizers). Metallurgic industries: classification of metals, general metallurgic methods. Silicate industries: raw materials, typical processes in silicate industries, glasses (glass characteristics and types, glass production) Cements: Portland cement, production of Portland cement, ceramic materials. Metallurgy of iron: iron production in blast furnace, production of steel, the Fe-C system. Production of aluminum: alumina production by the Bayer method, production of aluminum by the Hall-Heroult method.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of PowerPoint in lectures.
Communication via email.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>
<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>48</td></tr>
<tr><td>Written assignment</td><td>24</td></tr>
<tr><td>Not guided study</td><td>52</td></tr>
<tr><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>124</td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i></td><td></td></tr>
</table>

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek, with multiple choice questionnaires and short-answer questions. Written work with public presentation (20%).

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. ΑΝΟΡΓΑΝΗ ΧΗΜΙΚΗ ΤΕΧΝΟΛΟΓΙΑ, ΣΔΟΥΚΟΥ Α., ΠΟΜΩΝΗ Φ., ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Ο.Ε., 2010, 978-960-418-241-1.

2. Πράσινη Χημεία και Τεχνολογία στη Βιώσιμη Ανάπτυξη, Αναστάσιος Ζουμπούλης, Ευφροσύνη Πελέκα, Κωνσταντίνος Τριανταφυλλίδης, ISBN 978-960-603-089-5, Εκδόσεις Kallipos, 2015

- Related academic journals:

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**XHE 712**	**SEMESTER**	**7nd**
COURSE TITLE	**INTRODUCTION TO CLINICAL BIOCHEMISTRY**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	5
Laboratory exercises	0	0
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised general knowledge, skills development
PREREQUISITE COURSES:	According to the curriculum of the Department of Chemistry, there are no prerequisites. However, it is not possible to attend the course without the required knowledge of the courses Biochemistry I and II, Biochemistry Laboratory.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek or English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://ecourse.uoi.gr/course/view.php?id=1323

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of the course, and in accordance with Descriptive Indicator 6 of the European Qualifications Framework, candidates will be expected to demonstrate the following:

Knowledge

- A comprehensive understanding of the structure and function of the human body.
- Knowledge of the basic functions of individual human organs (e.g., liver).
- Understanding of the essential functions of the human body’s organ systems.
- Familiarity with the fundamental principles of immunology.
- Knowledge of the structural characteristics and functions of blood cells.
- Understanding of specialized metabolic pathways (e.g., cholesterol, fatty acid, bilirubin, uric acid, and urea metabolism).
- Awareness of the physiological roles of key plasma components (e.g., immunoglobulins, lipoproteins).
- Knowledge of the structure and function of the main hormones of the human body.

Skills

- Proficiency in using medical terminology commonly employed in Clinical Chemistry laboratories, diagnostic centers, and in communication between Clinical Chemists and healthcare professionals.
- Competence in understanding and applying specialized metabolic pathways relevant to the study of metabolic disorders covered in the Clinical Chemistry course.

Competencies

- Ability to apply theoretical knowledge to solve problems related to Clinical Biochemistry and Human Physiology.
- Capability to collaborate effectively with peers and researchers in the fields of Clinical Biochemistry and Physiology.
- Capacity to work both independently and as part of a team.
- Adaptability to perform effectively in high-paced, dynamic work environments.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general skills that the student must have acquired and that the course aims at are:

- Theoretical thinking and ability to convert theory into practice.
- Ability to apply knowledge acquired during the period of study and in the practical exercises of the Bachelor of Chemistry curriculum.
- Ability to search, analyze and synthesize data and information from the relevant literature and use the necessary technologies related to the presentation of research results.
- Acquisition of appropriate theoretical and practical knowledge of the undergraduate level to be able to pursue further education at the postgraduate and doctoral level.
- Work in an interdisciplinary environment.
- Ability to collaborate at a team level to achieve the above objectives.

(3) SYLLABUS

- Cellular structure and function
- The nerve cell (neuron) – Neurotransmitters
- Levels of organization of the human body
- Blood cells, structural and functional characteristics-physiological role
- Hemoglobin- Structure-functional role-Anemias
- Cataracts of the retina. Disorders of the retina-laboratory analysis.
- Elements of immunology: (Mechanisms of specific and non-specific immunity, immunoglobulins, blood group systems.
- Lipids-lipoproteins (structure of lipoproteins, apolipoproteins, metabolism of lipoproteins-lipids.
- Acid-base balance - electrolytes.
- Cardiovascular system
- Respiratory system (function of the respiratory role of the lungs, partial pressure of gases, transport of gases with the blood).
- Digestive system: (function of the stomach, digestive fluids-condition-role in the degradation of foods, absorption of food, gastrointestinal hormones).
- Neurological function – Liver production

- Hormones (Chemical classification, production-secretion-transport-degradation, mechanisms of action, laboratory methods of determination).
- Endocrine glands.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	○ Electronic communication via email or MS-Teams with the students ○ Support of learning lessons with power point ○ Teaching with the project method.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below

Activity	***Semester workload***
Lectures	80
Individual study, preparation	45
Course total (25 hours of workload per credit unit)	**125**

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Candidates are assessed through written final exams. The written exam consists of multiple-choice (50%) and short-answer or open-ended questions (50%).

(5) ATTACHED BIBLIOGRAPHY

Suggested literature:

- TSELEPIS, A., PANTAZI, D., & TELLIS, K. (2024). CLINICAL BIOCHEMISTRY – DIAGNOSTICS. [UNDERGRADUATE TEXTBOOK] KALLIPOS, OPEN ACADEMIC PUBLICATIONS. http://dx.doi.org/10.57713/kallipos-964
- CLINICAL CHEMISTRY. GAW ALLAN, COWAN ROBERT A., O’REILLY DENNIS S. J., STEWARTMICHAEL J., SHEPHERD JAMES
- HUMAN PHYSIOLOGY - MECHANISMS IN THE ORGANISM'S FUNCTION. VANDERA., SHERMAN J., LUCIANO D. BROKEN HILL PUBLISHERS LTD
- BASIC MEDICAL SCIENCES III: PHYSIOLOGY. NETER FRANK H. PASCHALIDIS PUBLISHING

Related scientific journals:

- Clinical Biochemistry
- Annals of Clinical Biochemistry

- Clinical Chemistry
- Journal of Molecular Physiology
- The Journal of Physiological Sciences

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	XHY074	**SEMESTER**	**7th**
COURSE TITLE	Lab of Physical and Chemical Processes		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	No

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Students will gain basic knowledge in issues of physical and chemical processes of chemical technology. The students will learn to search in literature and analyze data using new technologies. They will also be taught to respect the environment. Their survey and bibliographic work will promote free, creative and inductive thinking.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search, analysis and synthesis of data and information, by using the proper technologies.
Autonomous work
Respect of natural environment
Promoting free, creative and inductive thinking

(3) SYLLABUS

Theoretical presentation of the laboratory exercises. Filtration. Double pipe Heat exchanger. Continuous stirred tank reactor. Vapor quality. Rotary dryer. Absorption on solid. Study of single stage centrifugal fan, gas flow meters. Flotation. Stirring. Fluidized bed. Molecular weight determination of polymers using gel permeation chromatography. Fuels and lubricants test.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint in lectures. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination (80%) in Greek, with multiple choice questionnaires and short-answer questions. Written work with public presentation (20%).

Activity	*Semester workload*
Laboratory exercise	60
Written assignment	24
Not guided study	40
Course total	124

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΒΙΟΜΗΧΑΝΙΚΗΣ ΧΗΜΕΙΑΣ, *ΣΗΜΕΙΩΣΕΙΣ ΤΩΝ ΜΕΛΩΝ ΔΕΠ ΤΟΥ ΕΡΓΑΣΤΗΡΙΟΥ ΒΙΟΜΗΧΑΝΙΚΗΣ ΧΗΜΕΙΑΣ, ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ (ΣΗΜΕΙΩΣΕΙΣ), 2003*

- Related academic journals:

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHY401**	**SEMESTER**	5th
COURSE TITLE	**Physical Processes of Chemical Technology**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific area / skills development
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://www.chem.uoi.gr

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After the successful completion of the course, descriptive level 6, 7 of the European Qualifications Framework for Lifelong Learning, the students will be capable to: After successfully completing the course, descriptive marker 6 of the European Qualifications Framework, students should be able to:

- Understand the basic principles of unit operations for their industrial use.
- recognize how to design the process of manufacturing industrial products.
- formulate judgments that include reflection on scientific or ethical issues related to the cognitive content of industrial chemistry.

Knowledge

- Knowledge and understanding of the basic concepts of principles of unit operations.
- Knowledge and understanding of the applications of unit operations.
- Knowledge that implies the ability to critically understand the theories and principles of unit opertions.

Skills

- Has skills to solve problems related to physical processes.

Abilities

- Ability to apply his / her knowledge to address problems related to unit operations.
- Ability to interact with other students or researchers in unit operations.
- Ability to choose and apply the most appropriate methods to solve a specific research problem.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competences that the student should have acquired and to which the course is aimed are:

- Theoretical thinking and ability to apply the knowledge gained during the course "Physical Processes of Chemical Technology" as well as related courses of the Chemistry Department curriculum
- Ability to search, analyze and synthesize data and information from international bibliography and use the necessary presentation technologies, research results.
- Acquiring the appropriate theoretical knowledge base to allow further education at postgraduate level of specialization and doctorate.
- Working in an interdisciplinary environment.

Ability to collaborate at team level to achieve these goals.

(3) SYLLABUS

Introduction to Industrial Chemistry. The transition from the laboratory to the industrial scale. Classification of chemical industry processes. Classification of unit operations. Separation processes for raw materials preparation and for chemical product purification. Physical quantities, dimensional analysis. Material and energy flows in chemical industry. Flow diagrams. Introduction to mass and energy balances. Basics of thermodynamics. Introduction to transport phenomena - momentum, heat, mass.

Fluid mechanics. Fluids, fluid statics. Pressure and manometric head of fluid. Laminar and turbulent flow. Viscosity, Reynolds number. Newton's law and momentum transfer. Continuity equation. Bernoulli's equation. Shear stress, fluid velocity, Hydraulic resistance. Flow resistance in pipes. Transportation of fluids. Liquid transportation systems -pumps. Gas transportation systems-compression.

Heat transfer. Heat transfer with conduction, Fourier's law. heat transfer with convection. Newton's law of cooling. Heat transfer coefficients. Heat transfer with radiation. Stefan-Boltzmann law. Heat exchangers. P-V-T diagrams for pure substances. and its applications, fluids and ways of heating, P-V-T diagrams for pure substances, thermodynamic properties of biphasic systems, ideal thermal machine, Carnot cycle, Rankine cycle, industrial cooling. Freezing, liquefaction. Evaporation.

Mass transfer. Molecular diffusion, Fick's laws, equimolar counter diffusion, diffusion of single gas component, molecular diffusion in liquids, turbulent diffusion, Mass transfer with convection, Mass Transfer Coefficients.

Separation processes. Gas absorption, gas/liquid equilibrium in absorption, industrial solvents. Operations with differential mass transfer, packed towers. Distillation. Vapor/liquid equilibrium, ideal mixtures, real mixtures,P/xy, T/xy diagram. continuous fractional distillation.

Liquid extraction. Liquid/liquid equilibrium. Extraction of solids. Hydration/dehydratioin processes. Drying of solids. Absolute/relative humidity of air, vapor/solid equilibrium. Crystallization. Mixing processes. Membrane separation processes.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of Technologies of Information and communications in teaching and communication with students.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Written assignment</td><td>10</td></tr>
<tr><td>Not guided study</td><td>63</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>The evaluation of the students is done by written final examination (evaluation) in Greek which includes:
Written / oral final examination including:
• open-ended questions
• short answer questions
• answers to crisis questions
• problem solving.
Presentation of personal Work</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography (in Greek):
ΣΤΟΙΧΕΙΑ ΦΥΣΙΚΩΝ ΔΙΕΡΓΑΣΙΩΝ, ΖΟΥΜΠΟΥΛΗΣ ΑΝ., ΚΑΡΑΠΑΝΤΣΙΟΣ Θ., ΜΑΤΗΣ Κ., ΜΑΥΡΟΣ Π. ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Ο.Ε. 2009, 978-960-418-201-5.
ΒΑΣΙΚΕΣ ΔΙΕΡΓΑΣΙΕΣ ΧΗΜΙΚΗΣ ΜΗΧΑΝΙΚΗΣ, MC CABE WARREN L., SMITH JULIAN C., HARRIOTT PETER, ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Ο.Ε., 2015, 978-960-418-566-5.
ΦΥΣΙΚΕΣ ΔΙΕΡΓΑΣΙΕΣ: ΑΝΑΛΥΣΗ & ΣΧΕΔΙΑΣΜΟΣ, ΙΩΑΝΝΗΣ ΓΕΝΤΕΚΑΚΗΣ, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, 2010, 978-960-461-346-5.

- Related academic journals:

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHE 812**	**SEMESTER**	**8th**
COURSE TITLE	**CLINICAL CHEMISTRY**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	5
Laboratory exercises	0	0
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Course type/ Skills development
PREREQUISITE COURSES:	Not required
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek or English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://ecourse.uoi.gr/course/view.php?id=130

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of the course, and in alignment with Descriptive Indicator 6 of the European Qualifications Framework, candidates will be expected to demonstrate the following:

Knowledge

- Understanding of the fundamental principles of quality control procedures in the Clinical Chemistry laboratory.
- Knowledge of major metabolic disorders associated with dysfunctions of organs and physiological systems.
- Familiarity with key biomarkers associated with high-impact diseases in the general population, including cardiovascular diseases, diabetes mellitus, dyslipidemias, renal diseases, cancer, and others.
- Knowledge of standard routine tests performed in Clinical Chemistry laboratories and oncology diagnostic centers, along with their clinical relevance to corresponding pathologies.
- Understanding of the reference ranges for key biomarkers commonly used in routine diagnostic procedures.

Skills

- Ability to interpret biomarker levels to support the diagnosis of various diseases.
- Competence in distinguishing between different pathological conditions based on biomarker profiles.

Abilities

- Proficiency in applying theoretical knowledge to address and solve problems related to Clinical Chemistry.
- Capacity to engage in professional interaction and collaboration with fellow students and researchers in the field of Clinical Chemistry.
- Ability to work effectively both independently and as part of a team.
- Adaptability to work in diverse and multidisciplinary environments.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

……

Others…

…….

The general skills that the student must have acquired and that the course aims at are:

- Theoretical thinking and ability to convert theory into practice.
- Ability to apply knowledge acquired during the period of study and in the practical exercises of the Bachelor of Chemistry curriculum.
- Ability to search, analyze and synthesize data and information from the relevant literature and use the necessary technologies related to the presentation of research results.
- Acquisition of appropriate theoretical and practical knowledge of the undergraduate level to be able to pursue further education at the postgraduate and doctoral level.
- Work in an interdisciplinary environment.
- Ability to collaborate at a team level to achieve the above objectives.

(3) SYLLABUS

Course Content – Clinical Chemistry

- **Laboratory Testing in Clinical Chemistry**: Statistical evaluation of laboratory results, interpretation of reference values, clinical relevance, selection of appropriate laboratory methodologies, internal and external quality control procedures, and pre-analytical considerations including sample collection.
- **Biological Fluids**: Routine biochemical analyses of biological fluids.
- **Immunoassays**: Techniques including immunodiffusion, immunoelectrophoresis, chemical immunoassays, quantitative immunoassays, and radioimmunoassays.
- **Plasma Proteins**: Functions and laboratory evaluation of plasma proteins; pathophysiological causes of hypoproteinemia and hyperproteinemia; analysis of specific plasma proteins including immunoglobulins and associated disorders.
- **Clinical Epidemiology**: The role and significance of clinical information in Clinical Chemistry; application of epidemiological principles to disease diagnosis.
- **Lipids, Lipoproteins, and Atherosclerosis**: Plasma lipid profiles; classification and metabolism of lipoproteins; laboratory diagnosis of dyslipidemias; role of oxidized lipoproteins in the pathogenesis of atherosclerosis and cardiovascular disease.
- **Liver Function and Disorders**: Liver histology and primary functions; metabolism and disorders of bilirubin; types of jaundice; major liver diseases; biochemical markers used in the assessment of liver function.
- **Renal Function and Disorders**: Overview of renal diseases and acute renal impairment; glomerular disorders, proteinuria, nephrotic syndrome, and renal failure; laboratory findings indicative of renal dysfunction.
- **Electrolyte Imbalances**: Homeostatic regulation of water and sodium; clinical conditions such as hyponatremia and hypernatremia; potassium regulation and related disorders including hypokalemia and hyperkalemia.
- **Carbohydrate Metabolism Disorders**: Regulation of glucose homeostasis and hormonal control; diabetes mellitus and its metabolic complications; associated laboratory findings.
- **Pituitary Gland Disorders**: Laboratory differentiation of adenohypophyseal disorders; evaluation of posterior pituitary gland dysfunction.
- **Thyroid Gland Disorders**: Clinical and laboratory assessment of hyperthyroidism and hypothyroidism; biochemical evaluation of thyroid function.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	○ Electronic communication via email or MS-Teams with the students ○ Support of learning lessons with power point ○ Teaching with the project method.

TEACHING METHODS

The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS

Activity	*Semester workload*
Lectures	80
Individual study, preparation	45
Course total (25 hours of workload per credit unit)	**125**

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Candidates are assessed through written final exams. The written exam consists of multiple-choice (50%) and short-answer or open-ended questions (50%).

(5) ATTACHED BIBLIOGRAPHY

Suggested literature:

- TSELEPIS, A., PANTAZI, D., & TELLIS, K. (2024). CLINICAL BIOCHEMISTRY – DIAGNOSTICS. [UNDERGRADUATE TEXTBOOK] KALLIPOS, OPEN ACADEMIC PUBLICATIONS. http://dx.doi.org/10.57713/kallipos-964
- CLINICAL CHEMISTRY. GAW ALLAN, COWAN ROBERT A., O'REILLY DENNIS S. J., STEWARTMICHAEL J., SHEPHERD JAMES
- CLINICAL CHEMISTRY. MARSHALL WILLIAM, BROKEN HILL PUBLISHERS LTD

Related scientific journals:

- Clinical Chemistry
- Clinical Chemistry and Laboratory Medicine
- Clinical Biochemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**XHE 402**	**SEMESTER**	**8nd**
COURSE TITLE	**LABORATORY OF CLINICAL CHEMISTRY**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	0	0
Laboratory exercises	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Course type/ Special background, Skills development
PREREQUISITE COURSES:	Not required
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek or English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://ecourse.uoi.gr/course/view.php?id=840

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of the course, and in accordance with Descriptive Indicator 6 of the European Qualifications Framework, candidates will be expected to demonstrate the following:

Knowledge

- Understanding of the fundamental principles related to the organization and operation of a modern Clinical Chemistry laboratory, including its functional specifics and the applicable safety regulations.
- Knowledge of appropriate sample selection and interpretation techniques for biomarker determination.
- Familiarity with the methodological principles underlying the determination of biomarkers used in routine biochemical testing.
- Awareness of key biomarkers associated with major diseases impacting the general population, such as cardiovascular disease, diabetes mellitus, dyslipidemias, neurological disorders, and cancer.
- Understanding of contemporary methods commonly applied in clinical medicine.
- Knowledge of reference values for principal biomarkers used in routine laboratory assessments.
- Awareness of routine diagnostic tests currently conducted in Clinical Chemistry laboratories and cancer diagnostic centers, along with their relevance to corresponding pathological

conditions.

Skills

- Proficiency in applying suitable laboratory methodologies for the detection and quantification of various biomarkers.
- Ability to support clinical diagnoses by interpreting biomarker levels.
- Competence in the proper handling and processing of biological specimens.
- Effective communication and collaboration with peers and researchers within Clinical Chemistry settings.
- Ability to function efficiently both independently and as part of a multidisciplinary team.
- Capacity to operate effectively in high-demand, fast-paced laboratory environments.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general skills that the student must have acquired and which the course aims at are:

- Ability to apply knowledge acquired during the period of studies and in the related courses of the Department of Chemistry curriculum.
- Ability to search, analyze and synthesize data and information from the relevant bibliography and use the necessary technologies related to the presentation of research results.
- Acquisition of appropriate theoretical and practical knowledge of the undergraduate level to be able to pursue further education at the level of postgraduate studies and doctorates.
- Work in an international environment.
- Ability to collaborate at a team level to achieve the above goals.

(3) SYLLABUS

Laboratory of Clinical Chemistry Procedures

- **Hematological Testing**: Determination of hemoglobin concentration, hematocrit levels, and leukocyte differential count.
- **Protein Electrophoresis**: Analytical separation and identification of serum proteins.
- **Lipid Profile Assessment**: Measurement of total cholesterol, LDL-cholesterol, HDL-cholesterol, and triglycerides; lipoprotein electrophoresis for qualitative analysis.
- **Renal Function Evaluation**: Laboratory diagnosis of renal disorders, including general urinalysis, serum and urine creatinine determination, and calculation of creatinine clearance.
- **Nitrogen Metabolism Parameters**: Measurement of urea and uric acid concentrations.
- **Bilirubin Assessment**: Determination of total and conjugated (direct) bilirubin levels.
- **Liver Function Testing**: Laboratory evaluation of hepatic function through measurement of aminotransferase (ALT, AST) and gamma-glutamyl transferase (γ-GT) levels.
- **Evaluation of Metabolic Acidosis and Steatosis Syndrome**: Laboratory markers including creatine kinase-MB (CK-MB) and cardiac troponins.
- **Diabetes Mellitus Diagnosis**: Determination of blood glucose levels and related biochemical markers.
- **Iron Metabolism Assessment**: Measurement of serum iron levels and erythrocyte indices.
- **Hormonal Analysis**: Determination of β-human chorionic gonadotropin (β-hCG) levels.
- **Adrenal Function Evaluation**: Laboratory diagnosis of adrenal gland activity and associated hormonal profiles.
- **Genotypic Analysis**: Determination of apolipoprotein E (ApoE) genotypes for genetic and metabolic profiling.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face to face, Laboratory skills training</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>○ Electronic communication via email with the students
○ Support of learning lessons with power point</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td>
<table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Laboratory exercise</td><td>75</td></tr>
<tr><td>Individual study, preparation</td><td>15</td></tr>
<tr><td>Written report of the results of the laboratory exercise</td><td>35</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total
(25 hours of workload per credit unit)</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination,</i></td><td>The evaluation of the assignments includes:
1. Evaluation/grading of individual work based on a laboratory exercise (40%)
2. Written final exam including topic development (60%)</td></tr>
</table>

public presentation, laboratory work, clinical examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	

(5) ATTACHED BIBLIOGRAPHY

Suggested literature:

- TSELEPIS, A., PANTAZI, D., & TELLIS, K. (2024). CLINICAL BIOCHEMISTRY – DIAGNOSTICS. [UNDERGRADUATE TEXTBOOK] KALLIPOS, OPEN ACADEMIC PUBLICATIONS. http://dx.doi.org/10.57713/kallipos-964
- CLINICAL CHEMISTRY. MARSHALL WILLIAM, BROKEN HILL PUBLISHERS LTD

Related scientific journals:

- Clinical Chemistry
- Clinical Chemistry and Laboratory Medicine
- Clinical Biochemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	undergraduate		
COURSE CODE	**XHE724**	**SEMESTER**	**8th**
COURSE TITLE	INTRODUCTION TO PEDAGOGY: PEDAGOGICAL IDEAS AND EDUCATION		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	3	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://www.ecourse.uoi.gr

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Aim of the course is to achieve the following learning outcomes:

- To clearly define the conceptual content of basic concepts of the pedagogical cognitive field and to document its historical and epistemological evolution in order to understand the multiplicity and complexity of the term Education / Education Sciences.
- To clarify the distinction between Pedagogical Speech and Pedagogical Knowledge.
- To develop the relationship between pedagogical ideas and educational / school reality.
- To document the development of authoritarian pedagogy in the historical path of Modern Greek education.
- To introduce the basic theories of New Education and their long-lasting effects on Modern Greek educational reality.
- To describe the effect of psychoanalysis on pedagogical thinking
- To describe the effect of Radical Educational Ideas on Educational Reality.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Understanding and analyzing data and information
- Use of specific theoretical frameworks and their use in practice
- Adapt to new situations
- Criticism and self-criticism
- Participation in classroom discussion

(3) SYLLABUS

I. Pedagogy and Education / Education Sciences
1. Conceptual clarifications and epistemological developments
2. Educational discourse and pedagogical knowledge (savoir)
3. Pedagogical ideology and educational reality

II. Development and constitution of Autarchic Pedagogy
1. Historical view and layout
2. Versions of authoritarian pedagogy in education
3. Critical examination of contemporary aspects / practices of authoritarian pedagogy

III. Movement of New Education and its effects on modern Greek education: Pedagogical theories and school reality.

IV. Psychoanalysis, Pedagogy and School

V. Radical pedagogical ideas and "symbolic" violence: critique of educational institutions

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Support the learning process through the e-class platform. Using internet to enrich and document lectures. Use e-mail to communicate with students when required

TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

Activity	*Semester workload*
lectures	39
Study and analysis of bibliography	83
examination	3

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS		
	Course total	***125***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	1. Evaluation through written or oral examinations. • multiple choice • short-answer questions • open-ended questions, • written work • essay/report 2. semester assignments

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

- Mialaret, G. (1996). Εισαγωγή στις Επιστήμες της Αγωγής. (μτφρ.) Γ. Ζακοπούλου. Αθήνα: τυπωθήτω – Γ. Δαρδανός.
- Mialaret, G. (2008). Επιστήμες της Εκπαίδευσης. Η διαμόρφωση και η εξέλιξη ενός επιστημονικού πεδίου. (μτφρ.) Δ. Καρακατσάνη. Αθήνα: Μεταίχμιο.
- Hofstetter, R. & Schneuwly, B. (2004). Εισαγωγή στις επιστήμες της εκπαίδευσης. (μτφρ) Δ. Καρακατσάνη. Αθήνα: Μεταίχμιο.
- Πυργιωτάκης Ι.(2000). Εισαγωγή στην Παιδαγωγική Επιστήμη. Αθήνα: Ελληνικά Γράμματα.
- Houssaye, J. (2000). Δεκαπέντε Παιδαγωγοί σταθμοί στην ιστορία της παιδαγωγικής σκέψης. Αθήνα: Μεταίχμιο.
- Bartlett S./D. Burton (2019). Εισαγωγή στις επιστήμες της εκπαίδευσης. Βασιλόπουλος Σ. (Επιμ.), Αυγήτα Ε. (Μετάφραση). Αθήνα: Gutenberg.

ΔΙΔΑΚΤΙΚΑ ΕΓΧΕΙΡΙΔΙΑ

1. Διδακτικό Εγχειρίδιο
   Mialaret G. (2011). Περί παιδαγωγικής και εκπαίδευσης. Καλογιαννάκη Π., Καρράς Κ. (Επιμ.). Αθήνα: Gutenberg.

   Κωδικός βιβλίου: 12583785 ISBN: 978-960-01-1416-4

2. Διδακτικό Εγχειρίδιο
   Houssaye, J. (2000). Δεκαπέντε Παιδαγωγοί σταθμοί στην ιστορία της παιδαγωγικής σκέψης. Αθήνα: Μεταίχμιο.

   Κωδικός βιβλίου: 24031 ISBN: 978-960-375-131-1

3. Διδακτικό Εγχειρίδιο

Πυργιωτάκης, Ι. (2011). Εισαγωγή στην Παιδαγωγική Επιστήμη. Αθήνα: Πεδίο

Κωδικός βιβλίου: 12473595 ISBN: 978-960-9552-33-2

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**XHY 076**	**SEMESTER**	**7**
COURSE TITLE	Laboratory of Food Analysis and Technology		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	5	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised general knowledge, special background, skills development
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes. (English translated laboratory)
COURSE WEBSITE (URL)	-

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After the completion of the course, students will be able to perform various chemical analyzes concerning the composition, adulteration and quality of food using classical analysis techniques. In addition, they will correlate analytical data with food properties (adulteration, quality and food safety).

In addition, students will acquire the ability to interact with other students or researchers in food analysis, the ability to work in a group but to work independently.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search for, analysis and synthesis of data and information to address food packaging issues. Working independently. Practice criticism and self-criticism. Promoting free, creative and inductive thinking.
Acquiring the appropriate theoretical and practical knowledge background to enable further education at the level of postgraduate specialization studies and PhD.

(3) SYLLABUS

Determination of the chemical composition of foods, such as flour, honey, fats, milk, fruit juices, wine, meat products, drinking water. Includes determinations of food components, such as moisture, solid residue, ash, acidity, volatile acidity, fat, sugars, protein, ascorbic acid, ethanol. Also, study of food additives (sulfites, nitrites, improvers). In addition, it includes determination of physicochemical characteristics of foods, spectroscopic examination of olive oil, control of milk pasteurization, antioxidant activity of foods, control of spoilage (oxidation) and adulteration of foods.
Laboratory preparation of yogurt, canned fruit and study of food preservation (dehydration, pasteurization).

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-pace</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>Use of Power point for lectures.
Communication with graduate students via email and video conference</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>
<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>15</td></tr>
<tr><td>Laboratory exercise</td><td>50</td></tr>
<tr><td>Individual reports</td><td>25</td></tr>
<tr><td>Personal study</td><td>35</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td>125</td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>
<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>
<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>The language is Greek. For Erasmus students in English.
The evaluation of the students is done by a written final exam (50%) and Laboratory work (practise and report) (50%).
Written final exam includes:
- development
- short answer questions
- answers to critical questions
- solving problems and exercises
The grade of the written exam should be at least 5/10 to pass the course.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

Suggested Bibliography:

Teachers' Course Notes, University of Ioannina, (A. Badeka, I. Kosma)

Related Books

1. *Food Analysis, Nielsen S., Springer 2010.*
2. *Food Chemistry, Belitz H.-D., Grosch W., Schieberle P., Sprieger 1999.*

Related Scientific Journals:

1. Food Chemistry
2. Food Research International
3. Journal of Agricultural and Food Chemistry
4. Journal of Food composition and Analysis
5. Food Analytical Methods

ΠΕΡΙΓΡΑΜΜΑ ΜΑΘΗΜΑΤΟΣ

(1) ΓΕΝΙΚΑ

SCHOOL	NATURAL SCIENCES		
DEPARTMENT	CHEMISTRY		
STUDY LEVEL	UNDERGRADUATE		
COURSE CODE	**XHY 045**	**SEMESTER**	**4**
COURSE NAME	INORGANIC CHEMISTRY LABORATORY II		

TEACHING ACTIVITIES if credits are awarded in separate parts of the course eg Lectures, laboratory practicals, etc. If credits are awarded the same for the entire course, they should indicate the hours per week and the total of credits	**WEEKLY LECTURE HOURS**	**CREDITS**
	5	5

TYPE OF COURSE general background, special background, specialization, general knowledge, developing skills	Scientific area / Developing skills
PREREQUISITE COURSES:	There are no prerequisites. However, the knowledge of basic principles of inorganic chemistry with emphasis on coordination compounds (complexes) is desirable.
LANGUAGE TEACHING and EXAMINATION:	Greek
THE COURSE IS OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	It does not exist

(2) ΜΑΘΗΣΙΑΚΑ ΑΠΟΤΕΛΕΣΜΑΤΑ

Learning outcomes

The learning outcomes of the course the specific knowledge, skills and abilities appropriate level that will equip students after successful completion of the course are described

Refer to Appendix A

• Description of the Level of Learning Outcomes for each course according to the Qualifications Framework of the European Higher Education Area

• Indicators Descriptors Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Annex B.

- *Summary writing Guide of Learning Outcomes*

- *The aim of the course is the teaching and consolidation principles of inorganic chemistry through appropriate laboratory exercises and training of students in synthesis techniques and characterization of inorganic compounds*
- *Μετά την επιτυχή ολοκλήρωση του μαθήματος οι φοιτητές θα πρέπει να είναι σε θέση:*

After successfully completing the course, students should be able to:

1. To recognize the contribution of inorganic chemistry in the development of chemistry and science in general.

2. Be able to prepare coordination compounds using suitable synthetic methods.

3. Be able to isolate coordination compounds in pure form by using appropriate methods.

4. Be aware of some characteristic properties (geometry, coordination mode, etc.) of various metal ions.

4. Understand the geometric isomerism (eg cis, trans) in coordination compounds.

5. Be aware of basic principles (stability oxidizing conditions, kinetics, etc.) on the coordination chemistry of transition metal ions such as Cu2 $^{+}$, $Co^{2+/3+}$ etc.

6. To recognize the different types of coordination modes (monodentate, chelating, bridging etc.).

7. To interpret basic infrared and visible spectroscopic data of inorganic compounds and draw conclusions about the coordination mode of the ligands, the geometry/ isomerism of the metal complexes, the symmetry, crystal field stabilization energy etc.

8. Be able to calculate the yield of reactions involving the synthesis of coordination compounds.

9. To understand basic principles of the magnetochemistry of coordination compounds, to be able to perform magnetic susceptibility measurements at room temperature, to calculate the effective magnetic moment and thus be able to draw

conclusions on the oxidation state of the metal ions and discrimination in low-high spin compounds.

10. To familiarize themselves with important physicochemical properties of coordination compounds such as fluorescence-phosphorescence properties thermochromism etc and the technological importance of them.

11. To know the basic principles of coordination chemistry so that they will (a) be able to plan draw and name a coordination compound and its isomers (b) use relevant bond theories for predicting hybridization geometry, thermodynamic-kinetic stability etc. of metal complexes

Knowledge

Knowledge and understanding of basic concepts, principles and theories related to the synthesis and physicochemical characterization of coordination compounds.

Skills

Skills in the synthesis and purification of coordination compounds, use of spectrometers and the magnetic balance, interpreting IR and visible-ultraviolet spectroscopic data, processing magnetic susceptibility data at room temperature.

Complex problem solving skills through careful analysis of the data provided.

Capacities

Ability to apply the knowledge provided in troubleshooting (theoretical and synthetic) relating to Inorganic Chemistry.

Ability to prepare coordination compounds in pure form.

Ability to use spectrometers and magnetic balance.

Ability to interpret spectroscopic data.

Ability not only to work independently but also to interact with other students on the course topics.

General Skills

Taking into account the general competences to be acquired by the graduate (as listed in the DS and listed below) what / which of these skills the course is aimed ?

Search, analysis and synthesis of data and information, the use and the necessary technologies
Adapting to new situations
Decision making
Autonomous work
Teamwork
Working in an international environment
Work in a multidisciplinary environment
Generate new research ideas

Design and project management
Respect for diversity and multiculturalism
Respect for the natural environment
Demonstrate social, professional and moral responsibility and sensitivity to gender issues
Criticism and self-criticism
Promotion of free, creative and inductive thinking
......
Other ...
....

The general skills that should be acquired by the student and in which the course aims are:

Search, analysis and synthesis of data and information and making decisions.
Turning theory into practice.
Promotion of free, creative and inductive thinking.
Independent and teamwork.
Acquisition of the appropriate theoretical and practical knowledge base to enable the further training both in theory (in more specific subjects of Inorganic Chemistry) and in laboratory.

(3) COURSE SYLLABUS

Introduction to Inorganic Chemistry Laboratory. Safety measures. Demonstration of glassware and instruments. Introduction to the basic principles of infrared and visible spectroscopy and magnitochemistry of coordination compounds. Synthesis of cis-[C (en)$_2$Cl$_2$]Cl. Synthesis of trans- [Co(en)$_2$Cl$_2$]Cl. Study of cis-trans isomerism with IR. Study of cis-trans isomerism with visible spectroscopy. Synthesis of [Cu(OAc)$_2$ (H$_2$O)]$_2$ and [Cu(Sach)$_2$(H$_2$O)$_4$]. Synthesis of [Cu(tu)$_3$]$_2$SO$_4$. Study of the magnetic properties of copper complexes. Anti-ferromagnetism. Synthesis of [Cu(deen)2] (NO$_3$)$_2$.Synthesis of [Cu(deen)$_2$](BF$_4$)$_2$. Thermochromism. Synthesis of Alq$_3$. Fluorescence-phosphorescence. Synthesis of [Cr(en)$_3$]Cl$_3$. Calculation of crystal field stabilization energy of Cr (III) complexes.

In particular, the course consists of the following topics:

1. INTRODUCTION TO THE LABORATORY
Remind students basic safety rules in the laboratory and demonstration of basic laboratory equipment to be used for conducting the laboratory exercises.

2. INTRODUCTION TO PRINCIPLES OF INFRARED AND VISIBLE SPECTROSCOPY AND MAGNITOCHEMISTRY OF COORDINATION COMPOUNDS AND INTEGRATION
The principles of infrared and visible spectroscopy and magnetochemistry of coordination compounds are presented. Examples are given on the use of the above techniques in inorganic chemistry.

3.GEOMETRICAL ISOMERS. SYNTHESIS OF 1. trans and 2. cis - [Co(en)$_2$Cl$_2$]Cl (en = ethylenediamine) (three laboratory exercises)
The purpose of the experiment is the synthesis and characterization of the geometrical isomers of the complex [Co(en)$_2$Cl$_2$]Cl.
The experiment aims to demonstrate
(a) the stabilization of the oxidation state Co(III) in the presence of amino substituents
(starting from the lower stable oxidation state of Co(II))
(b) the difference between the properties (physical-chemical) of geometrical isomers and their different isolation metaods
(c) The identification-characterization of the isomers through spectroscopic data (visible and infrared spectroscopy)

4. CHEMISTRY OF Cu(II) AND Cu(I). STABILIZATION OF THE OXIDATION STATE OF Cu(I). METAL-METAL BONDS. STUDY OF MAGNETIC PROPERTIES (three laboratory exercises).
The purpose of the laboratory exercises is the synthesis and characterization of three Cu complexes in which the metal shows two of the most common oxidation states of copper (II and I).
Then, the study of their magnetic properties is performed.

5. SQUARE PLANAR Cu (II) COMPLEXES.
THERMOCHROMISM
The object of this laboratory exercise is the synthesis and characterization of two complexes Cu (II) which adopt a square planar geometry on the solid phase and the study of thermochromism phenomenon.

6. LUMINESCENCE-FLUORESCENCE-PHOSPHORESCENCE. SYNTHESIS OF

COMPLEX Alq3 (Hq = 8-hydroxyquinoline)

The purpose of the laboratory exercise is the synthesis and characterization of the complex Al (III) -8-hydroxy-quinoline and the study of its phosphorescence.

7. DETERMINATION OF THE CRYSTAL FIELD STABILIZATION ENERGY IN Cr (III) COMPLEXES. SYNTHESIS OF THE COMPLEX $Cr(en)_3Cl_3.3H_2O$. The SPECTROSCOPIC SERIES (two laboratory exercises)

The purpose of the laboratory exercise is the synthesis and characterization of the complex $Cr(en)_3Cl_3.3H_2O$. In addition, the effect of the ligand type (Cl, H_2O, en) on the crystal field stabilization energy of the Cr(III) will be studied. Based on these results, the students will place Cl, H_2O, en in their proper position in the spectroscopic series.

8. REPEATING OF LABORATORY EXERCISES

Students who were absent on specific exercise carry out the corresponding exercise and a tutorial lecture is delivered that covers the entire syllabus (for all students).

During the training of the students, emphasis is given on the connection of the theory taught in the context of Inorganic Chemistry courses with the practical laboratory exercises. Great emphasis is also placed on the characterization of inorganic compounds using the available physico-spectroscopic techniques.

(4) TEACHING and LEARNING METHODS - EVALUATION

LECTURE DELIVERY METHOD *Face to Face, distance learning κ.λπ.*	Face to Face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Using ICT in Teaching , Laboratory Training and in Communication with the students*	Electronic communication with students. Post-exercise additional notes etc. on the websites of teachers
ORGANIZING THE TEACHING *Describe in detail the methods of teaching. Lectures, Seminars, Laboratory Exercise, Field Exercise, Study and literature analysis, Tutorial, Practice (Placement), Clinical Practice, Art Workshop, Interactive teaching, Study Visits, Study (project), Writing job / work, Artistic creation etc.* *Enter the hours of study for each student learning activity and hours of Non-guided study in accordance with the principles of ECTS*	

ACTIVITY	*SEMESTER WORK LOAD*
Lectures	13
Laboratory exercise	52
Tutorial	13
Writing work	24
Individual study and preparation	23
TOTAL *(25 hours of work load per credit)*	***125***

STUDENT EVALUATION *Description of the evaluation process* *Assessment Language, Methods of assessment Formative or Concluding, Test Multiple Choice, Questions Short Answer, Development Questions Essays, Problem Solving, Written Work, Report / Report, Oral Examination, Public Presentation, Laboratory Work, Clinical Examination Patient Artistic Interpretation Other / other* *Indicate clearly defined evaluation criteria and whether and which are accessible to students.*	The students are graded based on their assignments in the context of the laboratory exercises, oral and / or a short written examination during the laboratory course and through written examinations at the end of the semester. Their assignments include the development of basic theory-purpose of the exercises, the experimental procedure and analysis-interpretation of results. The final exam include: Short Answer Questions, crisis, development, and problem solving All these criteria are explained to students at the start of the course.

(5) SUGGESTED LITERATURE

-SUGGESTED LITERATURE :

EYDOXOS

1., "BIOINORGANIC CHEMISTRY, Vol. 2: Synthesis and Study of Coordination Compounds", Thessaloniki 2006.
2., «Synthesis and Study of metal complexes", Thessaloniki 1999.

OTHERS

1. K. Nakamoto, "Infrared and Raman Spectra of Inorganic and Coordination Compounds, 5th edition, Parts A and B", Willey-Interscience
Pubs, 1997.
2. Butler, Harrod, «Inorganic Chemistry: Principles and Application», 1994
3. A.B.P. Lever, "Inorganic electronic spectroscopy (second edition), Elsevier, 1984
4. Zvi Szafran, Ronald M. Pike, Mono M. Singh, "Microscale Inorganic Chemistry", J. Wiley (1991).
5. http://orgchem.colorado.edu/hndbksupport/irtutor/tutorial.html
6.http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/Spectrpy/InfraRed/infrared.htm
7. http://riodb01.ibase.aist.go.jp/sdbs/cgi-bin/direct_frame_top.cgi
8.http://symmetry.otterbein.edu/tutorial/index.html
9. http://chemistry.bd.psu.edu/jircitano/TSdiagram.pdf

-Related Scientific Journals:
Inorganic Chemistry
European Journal of Inorganic Chemistry
Journal of Chemical education
Polyhedron
Inorganic Synthesis

COURSE OUTLINE

(1) GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Chemistry		
LEVEL OF STUDIES	Graduate		
COURSE CODE	**XHY501**	**SEMESTER**	**5**
COURSE TITLE	Spectroscopy Principles		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background
PREREQUISITE COURSES:	Basic knowledge of Physical Chemistry is needed
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successful completion of the course, the students have got to be ready for:

- To understand the basic principles involving Atomic and Molecular Spectroscopy.
- To get a clear picture about the rules and conditions for a wide range of spectroscopies, involving electronic transitions with variable energetic package

Knowledge

- Knowledge and understanding of basic principles and theories related to spectroscopy and atomic/molecular structure.
- Knowledge and understanding of basic experimental spectroscopic techniques and implementation towards the resolution of physicochemical problems.
- Knowledge in utilization of spectroscopic data of international literature.

Skills

- Skills in assessment of spectroscopic data by various techniques towards the resolution of physicochemical problems.

- Advanced skills to resolve research issues through data analysis of international literature.

Capabilities

- Capability to apply their knowledge to copy problems which are related to spectroscopy of either atoms, compounds, bulk materials or nanostructures.
- Capability to interact with either students, graduates and researchers to resolve issues of molecular spectroscopy.
- Capability to choose and apply the most appropriate spectroscopic methods towards the resolution of a specific research problem.
- Capability to act as team but also as individual researcher.
- Potential to work in international environment.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general competences that the student is going to access are:

- Theoretical consideration and capability to convert theory in experimental action.
- Capability to apply the employed knowledge during the period of diploma thesis and graduate studies.
- Capability to search, analysis and data/information combination from international literature and utilization of appropriate technologies related to the presentation of research projects.
- Acquiring of appropriate theoretical and practical background of knowledge in order to the easy transition to next level of studies, for example, Master and PhD.
- Working in multidisciplinary environment.
- Capability to collaborate in the level of research team in order to fulfill the research goals.
- Enhancement of free, critical and creational thought

(3) SYLLABUS

Atomic structure and atomic spectra. Molecular structure. Absorption and emission of irradiation, Intensity of spectral lines. Molecular symmetry, selection rules. Absorption spectroscopy UV-Vis. Rotational and vibrational spectra Raman–IR. Photophysical processes (fluorescence-phosphorescence). Monochromatic light soutces. Analysis of structures. Electron microscopies (Scanning EM – Transmission EM). Atomic Force Microscopy. Photoelectron Spectroscopy (XPS/UPS).

Introduction to X-ray Diffraction: Lattice, Miller indices and crystal structures, Bragg law. Physicochemical problems concerning spectroscopy.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face Practical application and demonstration of institutional instrumentation
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	*Use of ICT in teaching (power point presentations)*
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Evaluation of students takes place through written examination which includes: short answer queries, multiple choice questions, critical problems, exercises

Activity	*Semester workload*
Lectures	52
Tutorials	7
Non-directed study	13
Course total	***72***

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1) P.W.ATKINS, PHYSICAL CHEMISTRY, Translated edition.
2) Spectroscopy Notes, Second Edition, Prof. Efstathios Kamaratos, Univ. Ioannina (2005).

- Related academic journals:

Journal of Physical Chemistry

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undegraduate		
COURSE CODE	XHE 055	**SEMESTER**	2nd
COURSE TITLE	Biology		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background (It is particularly recommended for Chemistry students who will pursue fields such as Biochemistry, Clinical Biochemistry, Food Biochemistry, Microbiology, and Biotechnology.
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek Also, in ENGLISH for foreign students from universities abroad, e.g. Erasmus students. The course supervision material (annotated PowerPoint slides) is prepared in both languages.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://ecourse.uoi.gr/enrol/index.php?id=161 (Topic 1)

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After successfully completing the course, descriptive indicator 6 of the European Qualifications Framework, students should be able to:

- Uunderstand the basic concepts and principles of biology, especially those related to:

(a) energy flows in biological systems

(b) the basic principles of metabolism

(c) the concept of the cell

(d) the genetics, the terms of genetic information and the concept of the genome

(e) the phylogenetic classification of organisms

(f) the theory of Evolution and the analysis of biological processes based on the principles of evolutionary theory

- Understand the importance of experimental research in Biology and its connection with the generation of new research ideas
- Understand the need for interdisciplinary research, as the study of Biology refers to multiple levels of organization, the interpretation of which requires an inductive way of thinking and a multifaceted, integrated understanding of the most specific concepts

Knowledge

✓ Knowledge and understanding of basic concepts on which the study of Biology is based (Cells, Energy flows in biological systems, Information flows in biological systems, Genes, Genome, Evolution)
✓ Understanding the importance of experimental research and model organisms for the study of basic life processes
✓ Knowledge of the potential of modern applications of Biology in biotechnology and biomedical research
✓ Understanding of the interdisciplinarity required in biological research

Abilities

✓ Ability to analyze and evaluate information related to basic issues related to biological sciences
✓ Ability to critically analyze current issues related to modern developments in rapidly developing fields (e.g. genomics, biotechnology, biomedicine, environmental biology)
    ✓ Ability to combine studies from different knowledge areas in the broader field of Biology

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

The general skills that the student is expected to have acquired and which the course aims at are:

✓ Retrieval, analysis and synthesis of data and information, using the necessary technologies
✓ Independent work
✓ Group work
✓ Promotion of critical, creative and inductive thinking
✓ Understanding the essence of experimental research and its connection with the production of new research ideas

(3) SYLLABUS

An introduction to the basic concepts of Biology is given, covering as much as possible the historical development of the fundamental principles of Biology (e.g. evolutionary theory, the theory of the cell, genetics, discovery of DNA, principles of genetic information, important experiments-breakthroughs in Biology) as well as the most modern fields of Biology (e.g. genomics, systems biology, molecular evolution, biotechnology, biomedical research)

1. Basic concepts of Biology. Organization in levels. Genetics-Information-Structure-Function Evolution. Energy flows in biological systems. Basic principles of metabolism. ATPases.
2. Cells. Cellular structure. Biological membranes. Transmembrane transport. Basic types of cells. Eukarya. Bacteria. Archaea. Compartmentalization of eukaryotic cells.

Endoplasmic reticulum. Ribosomes. Protein synthesis. Golgi apparatus. Lysosomes. Nucleus. Chromatin. Mitosis. Cell cycle. Cytoskeleton.

3. Genome. Coding potential. Genes, gene families. Genomic programs. Evolution of the genome. Transposable elements. Introns. Alternative splicing. Functional genomics. Microelements. Proteomics. Genetic polymorphisms. SNPs. Genes associated with diseases. Local cloning. Gene targeting.

4. Evolution. Theory of evolution. Microevolution. Natural selection. Genetic drift. Gene flow. Biological species. Speciation. Origin of life. World of RNA. Celestial universal common ancestor (LUCA). Three-unit theory of life. Why archaea (Archaea) are a distinct phylum. Origin of eukaryotic cells. Endosymbiosis theory. Semiautonomous organelles. Evolutionary origin of mitochondria.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face (Auditorium)
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	✓ Course material (including previous exam papers) is posted on the University of Ioannina website (asynchronous e-learning platform, e-course). Website: https://ecourse.uoi.gr/enrol/index.php?id=161 (Topic 9) ✓ Electronic communication with students (via email and announcements posted on the e-course page). ✓ Learning support through use of PowerPoint slides in lectures.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Students are assessed by written examinations (assessment) in Greek which includes: 1. Examination of basic concepts 2. Short-answer questions 3. Answers to critical questions

Activity	***Semester workload***
Lectures	50
Tutoring-type Review lessons	25
Individual study preparation	50
Course total (25 hours of workload per credit unit)	125

(5) ATTACHED BIBLIOGRAPHY

Suggested literature:

- ✓ **Biology – Basic concepts and principles** (Cecie, S., Evers, C. A., and Starr, L.) Ed. UTOPIA (2015), Greek translation of the English book Biology – Today and Tomorrow (Brooks/Cole, Cengage Learning, 4th edition, 2013)
- ✓ **The Cell: A molecular approach** (Cooper, G. M., and Hausman, R.E.) Academic Publications Basdra (2013), Greek translation of the English book The Cell – A molecular approach (5th edition, Sinauer & ASM Press, Washington, D.C., 2009)
- ✓ **Biology** (Campbell, N., Reece, J., ...) (Section I: The chemistry of life – The cell – Genetics) Academic Publications Crete, I.T.E. (2010), Greek translation of the English book Biology (8th edition, Pearson Education, Inc., 2008)

- ✓ Selective chapters from section II of the book Biology (Campbell, N., Reece, J., ...) Academic Publications Crete, I.T.E. (2010) Provided in electronic form with permission from the publisher at the Website: site e-course: http://ecourse.uoi.gr/enrol/index.php?id=161 (Topic 9)

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	XHY 061	**SEMESTER**	6TH
COURSE TITLE	BIOCHEMISTRY II		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
		4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized General knowledge/Skills development		
PREREQUISITE COURSES:	None		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek or English		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)	https://ecourse.uoi.gr/enrol/index.php?id=601		

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After the successful completion of the course, descriptors for Level 6 of the European Qualifications Framework, the students must be able to

- Understand the intermediate metabolism of nitrogen containing biomolecules and complex lipids.
- Interpreter the mechanisms that control and regulate the intermediate metabolism and the signaling functions of hormones related to intermediate metabolism in organ specific manner and systemically.
- Understand the structure and function of nucleic acids.
- Understand the organization and expression of the genetic information.

Knowledge

- Basic concepts of metabolism
- The flow of the genetic information

Capabilities

- Capabilities to solve problems related to metabolism
- Capabilities to solve problems related to genetic information

Skills

- Apply the acquired knowledge in order to solve problems related to enzyme structure and to the mechanisms of enzymatic reactions
- Apply the acquired knowledge in order to solve problems related to DNA replication, transcription and translation.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Theoretical background and the application of theory in practical aspects
- Application of previously acquired knowledge into the concepts of Biochemistry and metabolism
- Ability to search for, analysis and synthesis of published data and information and the use of the necessary technology to present published data
- Acquisition of the foundation of knowledge that will facilitate students' post graduate studies

(3) SYLLABUS

Intermediate metabolism of nitrogen-containing biomolecules, Lipids metabolism, Signaling, Structure of nucleic acids, DNA synthesis, RNA synthesis, Protein synthesis

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	PowerPoint, MS-Teams to upload teaching material and complementary teaching. Communication via email.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational*	

Activity	***Semester workload***
Lectures	52
Tutorials	13
Study	60
Course total	**125**

visits, project, essay writing, artistic creativity, etc. *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Written examination • multiple choice questionnaires • short-answer questions • open-ended questions • problem solving

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:

BIOXHMEIA, REGINALD H. GARRETT AND CHARLES M. GRISHAM, CENGAGE LEARNING
BIOXHMEIA BERG J.M., TYMOCZKO J.L., STRYER L. ITE, ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ
LEHNINGER ΒΑΣΙΚΕΣ ΑΡΧΕΣ ΒΙΟΧΗΜΕΙΑΣ NELSON DAVID L., COX MICHAEL M. BROKEN HILL PUBLISHERS LTD

COURSE OUTLINE

1. GENERAL

SCHOOL	Natural Sciences		
ACADEMIC UNIT	Department of Chemistry		
LEVEL OF STUDIES	*Undergraduate*		
COURSE CODE	**XYH 203**	**SEMESTER**	2^{o}
COURSE TITLE	Computers - Informatics		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures and Labratory	3 (Lectures) +2 (Labratory)	5
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (4).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	General background
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described. Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

This is a course that introduces the student to the fundamental principles of Computer Science and Informatics with an orientation towards the requirements of Chemical Education. After completing the course (Theoretical and Laboratory part) the student is expected to be able to know:

1) the historical development of computer technology and the basic concepts of IT science,
2) the basic elements that make up the structure of the personal computer,
3) the Numerical systems, the execution of operations and the transformations of representations,,
4) the basic features of Computer Architecture, Operating Systems, Computer Networks and the Internet,
5) the use of the Internet to find scientific information (mainly in the field of Chemistry), the familiarity with Scientific databases (mainly in the field of Chemistry) and Software for designing graphical representations and molecular visualization,
6) the main concepts of algorithms and programming languages and the importance of the correct process of developing a program.
7) creating programs in the Python programming language to solve problems in the field of Chemistry and science in general.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology

Project planning and management
Respect for difference and multiculturalism

Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
Others

At the end of this course the student will have further developed the following skills:

1. Ability to demonstrate knowledge and understanding of basic concepts, principles and theories related to Computer Science and computer usage for advanced scientific applications as well as the use of the Internet.
2. Ability to use this knowledge and understanding as a starting point to expand to more complex computer manipulation objects as well as to approach other different, unfamiliar problems.
3. Ability to research and study IT subjects for continuous professional development.
4. Ability to interact with others, in computer handling and interdisciplinary nature problems.

More generally, upon completion of this course the student will have further developed the following general abilities (from the list above):

1. Search, analysis and synthesis of data and information, also using the necessary technologies.
2. Adaptation to new situations.
3. Decision making.
4. Autonomous work.
5. Exercise criticism and self-criticism.
6. Promotion of free, creative and inductive thinking.

3. SYLLABUS

Theory

Introductory concepts in computer systems
Computer architecture
Input / Output Devices
Numerical systems
Operating Systems
Computer networks – Internet
Software and applications
Using the internet to find scientific information
Scientific databases
Software for Mathematical Graphical design and molecular imaging software
Introduction to the Python programming language
Python scripting environments
Program structure
Variables and expressions. Logical expressions
Input data and output results
Basic data types. Operations between different data types
Flow control structures, iteration-loop structures, functions
Data structures. Lists, tuples, sets and dictionaries
Arrays using the NumPy and Scipy libraries
Mathematical functions, application to simple numerical problems
Programming Applications for Problem Solving in Chemistry
Data input and output to files
Error checking

Laboratory

Practical applications – Students practice programming in Python language (2 hours per week)

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face and laboratory

<table>
<tr><td></td><td>Distance learning</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>ICT is used. (slide show etc.) and blackboard in Teaching. The communication with the students and the distribution of the educational material, mainly through an appropriate platform (announcements, lecture slides and other educational material, posting and submitting assignments, user groups, discussions, electronic messages, exercises, glossary, multimedia), but also conventional e-mail. Laboratory for computer handling and practice through practical exercises in the subjects of the course. Extracting information and scientific data from the internet.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Δραστηριότητα</i></th><th><i>Φόρτος Εργασίας Εξαμήνου</i></th></tr>
<tr><td>Lectures</td><td>50</td></tr>
<tr><td>Laboratory</td><td>50</td></tr>
<tr><td>Independent Study</td><td>15</td></tr>
<tr><td>Examination</td><td>10</td></tr>
<tr><td></td><td></td></tr>
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<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td><i>Course total</i></td><td><i>125</i></td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>I. Written final exam including:
- Understanding the theory

II. Examination of the laboratory which includes:
- Solving exercises in the laboratory material</td></tr>
</table>

5. SUGGESTED BIBLIOGRAPHY

--Suggested bibliography::
-Related academic journals::

Εισαγωγή στην Πληροφορική και τους Υπολογιστές, Μποζάνης Παναγιώτης Δ., Έκδοση: 1η/2016, ISBN: 9789604185382, ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.
Εισαγωγή στην Πληροφορική και τις Εφαρμογές της, Παπάζογλου Παναγιώτης, ISBN: 9789604188239, ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.
Εισαγωγή στην πληροφορική, Evans Alan, Martin Kendall, Poatsy Mary Anne (Συγγρ.) - Σταματίου Γιάννης (Επιμ.), Έκδοση: 3η έκδ./2022, ISBN: 9789605864071, ΕΚΔΟΣΕΙΣ ΚΡΙΤΙΚΗ ΑΕ
Εισαγωγή στον Υπολογισμό και τον Προγραμματισμό με την Python, 3η έκδοση, Guttag John V., ISBN: 9789604911592, Α. ΠΑΠΑΣΩΤΗΡΙΟΥ & ΣΙΑ Ι.Κ.Ε.
Technology In Action, 16th edition, Evans Alan, Martin Kendall, Poatsy Mary Anne, Published by Pearson (September 18th 2020)
Introduction to Computation and Programming Using Python, Second Edition, With Application to

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**XHY 105**	**SEMESTER**	**A**
COURSE TITLE	PHYSICS		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
		4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://ecourse.uoi.gr/course/view.php?id=4065		

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After the completion of the course, postgraduate students will be able to:

- Understand the fundamental concepts of electric and magnetic fields, the forces associated with them, and the physical quantities that describe these phenomena.
- Solve problems in electrostatics and magnetostatics involving continuous linear, surface, and volumetric distributions of charges and currents, using Coulomb’s law, Gauss’s law, the Biot–Savart law, and Ampère’s law.
- Comprehend the relationship between electromagnetic physical quantities and the atomic and molecular properties of chemical systems.
- Know the integral form of Maxwell’s equations, recognizing their importance in the unification of electric and magnetic phenomena, and will be able to apply this knowledge to solve simple problems.
- Apply these core concepts of Physics to interdisciplinary fields within Chemistry.

Knowledge

- Knowledge and understanding of concepts, principles, and methodologies related to electromagnetism.
- Theoretical knowledge of the behavior of electric and magnetic fields, charges, and currents in relation to fundamental chemistry concepts.

Skills

- Integrative understanding of essential concepts and laws related to electrostatics, magnetostatics, and electromagnetism phenomena.
- Proficiency in applying mathematical tools (vector calculus, integrals) to describe physical phenomena.

Competences

- Ability to interpret everyday phenomena related to static electricity, magnetism, and electromagnetism.
- Ability to adopt an interdisciplinary approach and apply electromagnetism principles to the field of chemistry.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology. Production of free, creative and inductive thinking. Critical thinking. Problem solving.

(3) SYLLABUS

Physics and Measurement: Standards and units. Estimations and order of magnitude. Dimensions and dimensional analysis.
Vectors: Scalar and vector quantities. Properties of vectors. Unit vectors and vector components. Adding vectors. Multiplying vectors.
Electric Charge and Coulomb's Law: Properties of electric charges. Charging objects by induction. Coulomb's Law.
Electric Fields: Electric fields and electric field lines. Electric field due to a point charge and an electric dipole. A point charge and a dipole in an electric field.
Gauss's Law: Electric flux. Gauss's Law. A charged isolated conductor. Applications of Gauss's Law to various charge distributions.
Electric Potential: Work and energy, potential energy, and conservative forces. Electric potential energy of a system of charges. Electric potential and potential difference. Obtaining the value of the electric field from the electric potential. Electric potential of a point charge, dipole, continuous charge distributions, and charged conductors. Unified approach to electrostatic forces and electric potential energy in relation to chemical bonding.
Capacitance and Dielectrics: Definition of capacitance and calculating capacitance. Capacitors in series and parallel. Energy stored in an electric field. Capacitors with dielectrics. An atomic description of dielectrics. Dielectrics and Gauss's Law.
Current and Resistance: Electric current. Current density. Resistance and resistivity. Ohm's Law. A model for electrical conduction. Electrical power.
Magnetic Fields and Forces: Magnetic fields and magnetic forces. Motion of a charged particle in a uniform magnetic field. Application in the mass spectrometer. Crossed electric and magnetic fields: discovery of the electron and the Hall effect. Torque on a current loop. The magnetic dipole moment.
Magnetic Fields due to Currents: Biot–Savart Law. Magnetic field of a long straight current-carrying wire. Magnetic field of a current loop. The magnetic force between two parallel conductors. Ampère's Law. Magnetic fields in solenoids and toroids.
Electromagnetic Induction and Maxwell's Equations: Faraday's Law of Induction. Lenz's Law. Induced EMF and electric fields. Gauss's Law for magnetism. Induced magnetic fields. Maxwell's Equations.
Magnetic Properties of Matter: Magnetism and electrons. Bohr magneton. Diamagnetism, paramagnetism, ferromagnetism, and antiferromagnetism. Applications of magnetic materials.
Electromagnetic Waves.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
<i>Face-to-face, Distance learning, etc.</i></td><td>Face-to-pace</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
<i>Use of ICT in teaching, laboratory education, communication with students</i></td><td>- Use of Power point for lectures.
- The asynchronous e-learning platform ecourse of the University of Ioannina is used for providing lecture notes, practice exercises, and communication with students.</td></tr>
<tr><td>TEACHING METHODS
<i>The manner and methods of teaching are described in detail.</i>
<i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i>

<i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></td><td><table>
<tr><th><i>Activity</i></th><th><i>Semester workload</i></th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Study of bibliography</td><td>26</td></tr>
<tr><td>Personal study</td><td>44</td></tr>
<tr><td>Exams</td><td>3</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td>125</td></tr>
</table></td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
<i>Description of the evaluation procedure</i>

<i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i>

<i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></td><td>The language of evaluation is Greek.
Written exam with multiple choice, short-answer questions and problem solving.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

Suggested Bibliography:

- Fundamentals of Physics: Mechanics, Waves, Thermodynamics, Electromagnetism, Optics, Modern Physics, 1st Edition, Halliday David, Resnick Robert, Walker Jearl, (General Scientific Editor: Eustathios G. Styliaris), Gutenberg Press, Athens, 2021.
- Physics for Scientists and Engineers: Electricity and Magnetism, Light and Optics, Modern Physics, 8th Edition, Raymond A. Serway and John W. Jewett, (General Scientific Editor: Charis Varvoglis), Klidarithmos Press, Athens, 2013.
- General and Modern Physics, Prikas Athanasios, Ziti Press, 2008.