Course Outline

1) General

SCHOOL	SCIENCE		
DEPARTMENT	CHEMISTRY		
DEGREE	MASTER		
COURSE CODE	**18A7**	**SEMESTER**	**1**
COURSE TITLE	Contemporary spectroscopic methods and methods of determination and analysis. - Laboratory course		
INDEPENDENT TEACHING ACTIVITIES in the case that the credits are awarded to separate parts of the course e.g. Lectures, Laboratory Exercises, etc. If the credits are awarded uniformly for the entire course, enter the weekly teaching hours and total credits		**TEACHING HOURS PER WEEK**	**CREDITS**
	Theory-Laboratory training	3	7
Add lines if necessary. The teaching organization and methods used are described in detail in (d).			
COURSE TYPE *general background, special background, general knowledge specialization, skill development*	GENERAL BACKGROUND, GENERAL KNOWLEDGE SPECIALIZATION, SKILL DEVELOPMENT		
PREREQUISITE COURSES:	NO		
COURSE AND EXAM LANGUAGE:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS ?	IF NEEDED YES		
COURSE WEBSITE (URL)	**https://eclass.uoa.gr/courses/CHEM250/**		

(1) LEARNING OUTCOMES

LEARNING OUTCOMES

The learning outcomes, specific knowledge, skills and abilities of an appropriate level that the students will acquire after the successful completion of the course are described.

Consult Appendix A

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

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

• Comprehensive Guide to writing Learning Outcomes

The aim of the course is to disseminate knowledge about a wide range of modern spectroscopic methods and laboratory techniques, which are employed for the identification of chemical compounds and products, as well as for their qualitative and quantitative analysis.

More specifically, in the context of this course, students are taught:
Theory and practice in the techniques of the existing research instruments in the Laboratory of Inorganic Chemistry and other Departmental Laboratories in which there may be easy access:

- Vibrational spectroscopy (infrared / FT-IR)
- UV/VIS Spectroscopy and Reflectance
- Fluorescence spectroscopy
- Nuclear Magnetic Resonance (NMR) spectroscopy
- Circular dichroism (CD)
- Electrochemical techniques, Cyclic Voltammetry (CV), et al.
- Electron Paramagnetic Resonance (EPR)
- High Performance Liquid Chromatography (HPLC)
- Gas Chromatography (GC)
- X-ray fluorescence (XRF)
- TCD
- Viscometry
- Porosimetry
- Inert atmosphere systems (glove-box, Schlenk lines)
- Thermal analysis: Thermogravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC)

Knowledge

- Knowledge and understanding of the basic principles of each experimental technique.
- Knowledge and understanding of the capacities and the specifications of the instruments.
- Knowledge and understanding of the operation of the instruments.
- Knowledge and understanding of the raw data obtained from the instruments.

Skills

- Skills in the use of scientific instruments and experimental techniques.
- Skills in evaluating and combining experimental data obtained with different techniques.
- Skills in choosing the right method for analysis in order to get the desired information (structural, mechanistic, etc.).
- Skills in solving problems via analysis of experimental data.

Abilities

- Ability to apply the knowledge gained in dealing with problems related to Inorganic Chemistry.
- Ability to interpret experimental data and to correlate them with specific chemical processes or structures.
- Ability to work safely in a chemical laboratory.
- Ability to interact with other students.
- Ability in carrying out a scientific literature search, in writing up and presenting a scientific essay.

General Skills

Taking into account the general skills that the graduate must have acquired (as stated in the Diploma Appendix and listed below) which of the following is/are the course aimed at?.

Reearch, analysis and synthesis of data and information, using the necessary technologies
Adaptation to new situations
Decision making
Independent work
Teamwork
Working in an international environment
Working in an interdisciplinary environment
Generating new research ideas
Project planning and management
Respect for diversity and multiculturalism
Respect for the environment
Demonstrating social, professional and ethical responsibility and sensitivity to gender issues
Exercise criticism and self-criticism
Promotion of free, creative and inductive thinking
Other…….

The general skills that the student should have acquired and that the course is aiming at are:

- Search, analysis and synthesis of data and information, using the necessary instruments and techniques.
- Autonomous work.
- Group work.
- Work in an international environment.
- Work in an interdisciplinary environment.
- Promotion of free, creative and inductive thinking.
- Decision making.

(2) COURSE CONTENT

This course deals with imparting knowledge about a wide range of modern spectroscopic methods and laboratory techniques used both for the identification of chemical compounds and reaction products and for their qualitative and quantitative analysis. In particular, within the framework of the specific course, the following are taught: Theory and practice in the techniques of the existing research instruments in the Laboratory and others to which there may be easy access: Vibrational spectroscopy (infrared / FT-IR). Visible and reflection spectroscopy. Fluorescence. NMR Spectroscopy. Circular dichroism (CD). Electrochemical techniques for studying the structure, cyclic voltammetry, etc. Electronic Paramagnetic Resonance (EPR). HPLC. GC. XRF. TCD. Porosimetry. Inert atmosphere systems. Thermal analysis (TGA/DSC).

(3) TEACHING AND LEARNING METHODS – EVALUATION

<table>
<tr><td>LECTURES' DELIVERY
In person, distance, etc..</td><td>In person</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGIES
Use of I.C. T. in Lectures, Laboratory Exercises, Communication with students</td><td>In Teaching:
Presentations with multimedia content (power point).
In Communication with students:
Support the learning process through the e-class electronic platform (announcements, information, messages, documents, user groups, etc.).
Email.</td></tr>
<tr><td>TEACHING ORGANIZATION
The teaching style and methods are described in detail.
Lectures, Seminars, Laboratory Exercises, Field Exercises, Literature Study & Analysis, Tutorial, Internship (Placement), Clinical Exercises, Art Workshop, Interactive Teaching, Educational Visits, Study Preparation (Project), PaperWriting Assignments, Artistic Creation, etc. etc.

The student's study hours for each learning activity as well as unguided study hours according to ECTS principles are listed</td><td><table><tr><th>Activity</th><th>Semester workload</th></tr><tr><td>Lectures</td><td>26</td></tr><tr><td>Laboratory training</td><td>78</td></tr><tr><td>Unguided study</td><td>61</td></tr><tr><td>Study preparation</td><td>10</td></tr><tr><td>total</td><td>175</td></tr></table></td></tr>
<tr><td>STUDENT EVALUATION
Description of the evaluation process

Assessment Language, Assessment Methods, Formative or Deductive, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Report / Report, Oral Examination, Public Presentation, Laboratory Work, Clinical Patient Examination, Artistic Interpretation, Other / Others</td><td>The evaluation of the course takes place in Greek and includes:
written exam that includes multiple choice questions, short development of theoretical issues, judgment, as well as problem solving.</td></tr>
</table>

Explicitly defined evaluation criteria are mentioned, and if and where they are accessible by students.	

(4) RECOMMENDED BIBLIOGRAPHY

- J. Sestak, Thermophysical properties of solids. In: G. Svehla, ed. Comprehensive Analytical Chemistry: Volume XII, Thermal Analysis Part D. New York, NY: Elsevier Science Publishing 1984. ISBN 0-444-99653.
- B. Valeur, Molecular Fluorescence: Principles and Applications, Wiley 2001. ISBN 3-527-60024-8
- A. J. Bard, L. R. Faulkner, Electrochemical Methods - Fundamentals and Applications, 2nd Ed., John Wiley & Sons, Inc. 2001. ISBN 978-0-471-04372-0.
- R. Holze, Experimental Electrochemistry - A Laboratory Textbook, 2nd Ed., Wiley-VCH 2009. ISBN 978-3-527-33524-4.
- F. Scholz, Electroanalytical Methods - Guide to Experiments and Applications, 2nd Ed., Springer-Verlag Berlin Heidelberg 2010. ISBN 978-3-642-02914-1.
- S. Berger, S.Braun, 200 and More NMR Experiments: A Practical Course, Wiley-VCH, 2004. ISBN: 978-3-527-31067-8.
- J. M. Sanders, E. C. Constable, B. K. Hunter, C. M. Pearce, Modern NMR Spectroscopy: A Workbook of Chemical Problems, 2nd Ed., Oxford Press. ISBN: 978-0198558125.
- S. Berger, S. Braun, 200 and More NMR Experiments: A Practical Course, Wiley-VCH, 2004. ISBN: 978-3-527-31067-8.
- A. Abragam, B. Bleaney, Electron Paramagnetic Resonance of Transition Ions, Dover Publications, New York, 1986. ISBN: 978-0199651528.
- K. Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds, Part A: Theory and Applications in Inorganic Chemistry, 6th Ed., John Wiley & Sons, Inc. 2009. ISBN: 9780471743392.
- https://repository.kallipos.gr/bitstream/11419/6175/2/01_chapter_7.pdf, Kallipos repository 2015, introduction-to-infrared-spectroscopy (in Greek).
- https://www.intechopen.com/books/infrared-spectroscopy-materials-science-engineeringand-technology/introduction-to-infrared-spectroscopy, Kallipos repository 2015, introduction-to-infrared-spectroscopy (in English).
- R. J. Errington, Advanced practical inorganic and metalorganic chemistry. London, Blackie Academic and Professional 1997. ISBN: 9780751402254.