COURSE OUTLINE

(1) GENERAL

SCHOOL	Sciences		
ACADEMIC UNIT	International Graduate Program in Biological Inorganic Chemistry		
LEVEL OF STUDIES	Graduate		
COURSE CODE	**2**	**SEMESTER**	**1**
COURSE TITLE	Physicochemical, Spectroscopic and Biochemical Methods in Bioinorganic 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**
		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 Special background Specialised general knowledge
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek / English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://bic.chem.uoi.gr/BIC-En/physical-en.html

(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 familiarize students with the physicochemical, spectroscopic and biochemical methods used in Bioinorganic Chemistry. In addition, students are taught the basic principles of instruments operation used in chemical analysis, their applications, their characteristics and uses and to evaluate their results.

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

- know basic analytical / physicochemical methods and to choose the most appropriate method based on the properties of compounds.
- interpret spectra, identify characteristic peaks of infrared spectra and make structure and spectrum correlation.
- Organize the analysis by selecting the correct method, taking into account the relevant parameters (interferences) and making the necessary calculations.
- analyze by selecting the correct method, taking into account the relevant parameters (interferences) and making the necessary calculations.
- understand the basic meanings of spectrophotometry, laws and apply them to chemical

analysis.

- Understand the principle of samples preparation, protocol used, sampling patterns and samples' maintenance.
- be familiar with the basic methods of molecular structure determination and study of biomolecular properties in solution and solid state.

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*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

The general competences that the student should have acquired and to which the subject is aimed are:
Search for, analysis and synthesis of data and information and decision making
Translating the theory into practice
Production of free, creative and inductive thinking
Working independently and team work
Acquire the appropriate theoretical base to allow further education at a doctoral level (theoretical and laboratory).

(3) SYLLABUS

Ultraviolet and Visible Spectroscopy, electronic transitions, radiative processes, energy diagram, internal conversion, conical intersection, structure determination and solvent effect

Fluorescence spectroscopy, Stokes Shift, fluorescence, experiments
, quenching, lifetime and quantum yield, fluorescence anisotropy
Infrared Spectroscopy,
Raman Spectroscopy
Mass spectroscopy. Ionization methods.
Electron spin resonance spectroscopy.
Spectroscopic methods for structure analysis such as mass spectrometry, nuclear magnetic resonance spectroscopy, infrared spectroscopy, and ultraviolet spectroscopy. Fundamentals of the NMR phenomenon, relationship between NMR spectra and molecular structure. Recording of routine spectra (1H and 13C), esssentials of data processing (e.g., weighting functions). 1D NMR techniques: Decoupling, DEPT, relaxation measurement, magnetisation transfer, NOE difference spectra. 2D NMRtechniques: Homo- and heteronuclear correlation (COSY, TOCSY, HSQC, HMBC), measurement of the nuclear Overhauser effect (NOESY, ROESY).
Cyclic voltamentry
Mass spectroscopy ESI, FAB, FD, MALDI-TOF ionization procedures.
X-ray,, Bragg's Law, • What's in a crystal?, space group symmetry, non-crystallographic symmetry, impossible symmetry , Practical Details, growing crystals, sample preparation, X-ray sources, data collection, Solving Structures from Diffraction Images

(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, PowerPoint
TEACHING METHODS *The manner and methods of teaching are described in detail.*	

Activity	*Semester workload*
Lectures	65

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*	Essay writing	60
	Individual study, preparation	70
	Course total	***195***
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, concerningother* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Student evaluation is done either by presenting to a committee of teachers and a public audience or by the final written examination. The final examination includes: Multiple Choice, short-answer, open-ended, and Problem Solving Questions.	

(5) ATTACHED BIBLIOGRAPHY

Suggested Bibliography

1) Infrared and Raman Spectra of Inorganic and Coordination Compounds: Part A: Theory and Applications in Inorganic Chemistry, Sixth Edition, Kazuo Nakamoto, Print ISBN:9780471743392, Online ISBN:9780470405840, DOI:10.1002/9780470405840, Wiley on line
2) Physical Methods for Chemists, Russel S. Drago, second edition, Surfside scientific publishers, 1992, USA.
3) Molecular Magnetism, Olivier Kahn
4) Crystal Structure Analysis. Principles and Practice Clegg, W., Blake, A.J., Gould, R.O. and Main, P.
5) Instrumental methods in Electrochemistry, Southampton Electrochemistry Group, Elis Horwood Ltd, 1990
6) Lectures Notes

Related academic journals:

Inorganic Chemistry, Dalton Transactions, Polyhedron, Inorganica Chimica Acta