COURSE OUTLINE

(1) GENERAL

SCHOOL	Sciences			
ACADEMIC UNIT	International Graduate Program in Biological Inorganic Chemistry			
LEVEL OF STUDIES	Graduate			
COURSE CODE	**1**	**SEMESTER**	**1**	
COURSE TITLE	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**
Face to face				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/bioinorganic-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 the teaching and understanding of the basic principles of Biological Inorganic Chemistry - Bioinorganic Chemistry that are considered necessary for the completion of postgraduate students' education. Also, the aim of this course is to present and describe bioinorganic systems through the correlation of the function, structure and activity of inorganic elements within the organisms. In particular, this course will include: a) a systematic study of trace element biosystems; b) the effect of the concentration of trace elements on health and the environment; and c) the pharmaceutical chemistry of the inorganic compounds.

- Upon completion of this course the students will be able to:

1. recognize the contribution of chemistry of metal molecules to the development of chemistry and other related fields.
2. evaluate the role of metal ions in biological systems.
3. know the function of metalloporphyrins of hemoglobin in oxygen binding by metal ions.
4. know the structure and function of metalloenzymes and metalloproteins.

5. know the iron biochemistry.
6. understand the role of metal ions in photosynthesis, cobalamine B12 and in basic functions of living organisms.
7. know how trace elements are involved in basic functions of the body.
8. recognize the applications of metal biomolecules in growth.
9. evaluate the applications of metal biomolecules as metallotherapeutic agents.
10. know metal biomolecules' applications as photoactive drugs.
11. evaluate applications of metal biomolecules as diagnostic agents.
12. know the applications of metal molecules in toxicology.

Knowledge
Knowledge and understanding of basic concepts, principles and theories related to Biological Inorganic Chemistry-Biochemistry, the role of metal ions in biological systems, the structure and function of metalloproteins and metalloenzymes, the role of metal ions in nucleic acids and 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 to deal with problems related to Biological Inorganic Chemistry and Bioinorganic Chemistry.
Ability to evaluate the bond type of metal ions with biomolecules.
Ability to correctly evaluate-chooses the data provided to solve complex problems.
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	*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 students should have acquired 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

Course Theory: electron transfer-metalloproteins. Blue copper proteins (hemocyanin, etc.). Photosynthetic systems. Competitive metal action. Metalloporphyrins. Iron proteins (e.g., ribonucleotide reductase, ferredoxin, etc.). Enzyme-Coenzymes (e.g., cyanocobalamin B_{12}, thiamine, etc.). Metal interactions with DNA, RNA and their derivatives. Metal based drugs such as Pt antitumor agents and other metals such as Pd, Sn, Ti, V, Ru etc as antiarthritic, antibacterial, antiviral agents etc.. Radiopharmaceuticals in diagnosis and treatment. Interactions of metal ions with peptides and proteins as models of biological systems. Heavy metal poisoning. Environmental Inorganic Biological Chemistry. Biocatalysts and biomimetic materials.

(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.* *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.*	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

Activity	***Semester workload***
Lectures	65
Essay writing	60
Individual study, preparation	70
Course total	***195***

(5) ATTACHED BIBLIOGRAPHY

1. Βιοανόργανη χημεία, Δημήτριος Κεσίσογλου, Γεώργιος Ψωμάς, Εκδόσεις 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.

Additionally suggested bibliography
Metal Ions in Biological Systems, 43 Vol. Set, CRC Press.

- Related academic journals:
Metallomics, Journal of Biological Inorganic Chemistry, Journal of Inorganic Biochemistry, Bioinorganic Chemistry & Applications, Inorganic Chemistry, Dalton Transactions, Inorganica Chimica Acta