UCLouvain

lgbio2030

2018

Biomaterials

5 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Demoustier Sophie ;Dupont Christine ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	General introduction to main classes of biomaterials: structure of natural and synthetic materials (polymers, ceramics and glasses, metals and composites). Properties of biomaterials: mechanical properties, surface vs bulk properties, physical and chemical properties, degradability, etc. This includes the study of living organism-material interactions: protein adsorption, cell adhesion, inflammatory and immune reactions, coagulation, etc. Examples of application of different classes of biomaterials in medicine: cardiovascular and orthopedic devices, dental materials, tissue engineering, etc.
Aims	With respect to the AA referring system defined for the Master in Biomedical Engineering, the course contributes to the development, mastery and assessment of the following skills : • AA1.1 • AA2.1, AA2.3, AA2.5 • AA3.1, AA3.3 • AA4.3 • AA5.1, AA5.4, AA5.5, AA5.6 • AA6.1, AA6.3 1 At the end of this teaching unit, the student will be able to: • Describe the structure and properties of different classes of biomaterials, and explain the principles governing living organism-material interactions; • Analyze the choice of a biomaterial for a given function. Through the preparation of the project (see "learning process" hereunder), the student will also be able to: • Write a synthetic report based on the content of a dozen of scientific articles related to a selected topic; • Present orally, in a clear and synthetic manner, the achievements of the project to an audience with basic knowledge in biomaterials science. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	• Final written or oral exam during the session (60 % of final grade) • Project evaluation (40 % of final grade): the written report is taken into account, as well as the oral presentation in front of the students participating to the course. • For students registered for a partim (LGBIO2030A, 3 ECTS), the final grade is solely based on the final examination.
Teaching methods	The first part of the teaching unit consists in lectures covering three axes: (i) principles of biology related to host-biomaterial interactions; (ii) general introduction to main classes of biomaterials: structure of natural and synthetic materials (polymers, ceramics and glasses, metals and composites); (iii) properties of biomaterials: mechanical properties, physical and chemical properties, surface properties, and relation between these properties and host-material interactions. The second part of the teaching unit includes a series of application of different classes of biomaterials in medicine, biology and artificial organs: biomaterials for cardiovascular applications, orthopedic prostheses, dental materials, drug delivery systems, biosensors, tissue engineering, etc. This part of the course is illustrated through presentations by experts from research and industry. Moreover, the visit of a company active in the field of biomaterials may be proposed. The third part of the teaching unit consists in a project, prepared by teams of two to three students. On the basis of at least a dozen of scientific papers or book chapters, the students will discuss a current issue in biomaterials science. Regular mentoring session with the teachers are organized, to orient students in their search of appropriate literature, and to help them structuring and writing the report. At the end of the semester, the work is presented to the other students following the same teaching unit.
Content	Part 1 : General introduction to main classes of biomaterials • 1.1 Polymers

	• 1.2 Metals • 1.3 Ceramics • 1.4 Compositifs • 1.5 Hydrogels • 1.6 Natural Materials Part 2 : Properties of biomaterials • 2.1 Mechanicals properties • 2.2 Surface vs bulk properties • 2.3 Living organism-biomaterial interactions Part 3 : applications of biomaterials in medicine
Inline resources	Moodle http://moodleucl.uclouvain.be/course/view.php?id=7830
Bibliography	• Notes de cours sur Moodle Livre de référence (exemplaires prêtés aux étudiants par groupe) : Biomaterials : The intersection of Biology and Materials science : Int. Edition J. Temenoff & A. Mikos, Pearson Education
Other infos	The course can be taken as a partim [LGBIO2030A] (3 ECTS, 30 h + 10 h). In such case, the student does not prepare a project, but participates to project presentation by other student.
Faculty or entity in charge	GBIO

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Computer Science and Engineering	INFO2M	5		
Master [120] in Chemical and Materials Engineering	KIMA2M	5		
Master [120] in Biomedical Engineering	GBIO2M	5		
Master [120] in Mathematical Engineering	MAP2M	5		