UCLouvain

lgbio2030

2024

Biomaterials

5.00 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Demoustier Sophie ;Dupont Christine ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	Students need to master the following skills, basic concepts in general chemistry and chemical physics, organic chemistry and biochemistry, and biology and cellular physiology taught during the Bachelor's degree (e.g. in the following courses : LFSAB1301 or LCHM1111, LBIR1220A, and LGBIO1111 or LBIR1150)
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.
Learning outcomes	**At the end of this learning unit, the student is able to :** 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.
Evaluation methods	Final indivudual oral or written exam during the session (50 % of final grade). The exact modalities will be communicated at the latest in week 4 when the number of students attending the course will be known. Project evaluation (50 % 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. *The mark attributed to the work done during the semester (that means, the mark attributed for the group project work) is acquired for all the sessions of the academic year, by virtue of the article 78 of the RGEE. Except exceptional situations, the evaluation takes the group performance into account and is identical across the group students. Individual students who would not have provided a fair personal contribution within their group will perform individual complementary work (to be determined) that will be evaluated within the exam session of September.* 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 lectures als includes a series of applications of different classes of biomaterials in medicine, biology and artificial organs. This part of the course could also be illustrated through presentations by experts from research and industry. The second part of the teaching unit consists in a project, prepared by teams of four to five students. On the basis 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 https://moodle.uclouvain.be/course/view.php?id=1156
Bibliography	Livre de référence e-textbook : Biomaterials Science – An Introduction to Materials in Medicine (Eds BD Ratner, AS Hoffman, JE Lemons, FJ Schoen,), third edition, Elsevier Academic Press, San Diego, 2012. The full text book is available online on Ebook Central (when you are logged on the UCLouvain network)
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	Learning outcomes
Master [120] in Chemical and Materials Engineering	KIMA2M	5		
Master [120] in Biomedical Engineering	GBIO2M	5		
Master [120] in Chemistry and Bioindustries	BIRC2M	5		
Master [120] in Computer Science and Engineering	INFO2M	5		
Master [120] in Mathematical Engineering	MAP2M	5		
Master [120] in Agricultural Bioengineering	BIRA2M	5		