UNIVERSITY OF GOTHENBURG

PHYSICS

FIM604 Materials in medicine, 7.5 higher education credits

Medicinska material, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Physics on 2017-06-20 to be valid from 2017-07-01, autumn semester of 2017.

Field of education: Science 100%
Department: Physics

Position in the educational system

The course is elective within the master programs in physics.

The course can be part of the following programmes: 1) Complex Adaptive Systems, Master's Programme (N2CAS), 2) Physics of Materials and Biological Systems, Master's Programme (N2PMB) and 3) Physics, Master's Programme (N2PHY)

Main field of studies	*Specialization*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Entry requirements

Bachelor in physics, chemistry, or similar

Learning outcomes

The aim of this course is to introduce the student to the main categories of materials used as biomaterials, with emphasis on their structure-property relationships, and to provide an introduction to specific materials commonly used in medical devices, as well as drug delivery and tissue engineering applications. Another aim is for students to be

familiar with the special handling, performance and degradation criteria required for materials in medicine.

Knowledge and understanding
On successful completion of the course the student will be able to:

Understand the basic structure and property relationships of metal, ceramic, polymeric and composite materials systems.

Understand structure-property relationships of biological materials, including major tissues found in the body.

Be familiar with characterization methods commonly used to analyse biomaterials.

Name and describe a few specific materials in each of the main catagories of materials used in medicine, such as metals, ceramics, polymers, degradable polymers, biopolymers.

Have an understanding of the requirements for materials used in several application areas in the body, such as soft tissue replacements, hard tissue replacements, blood contacting devices, as well as transplants and tissue engineered devices.

Describe some advantages and disadvantages of the main sterilization methods used in the medical device industry.

Describe the main degradation mechanisms of materials in the body.

Course content
The course is built upon the principle of understanding the specific properties of the different material types used as biomaterials, and how this understanding can be used for selecting/designing materials for different medical implant applications.

The course provides a necessary background for students in biotechnology, biomedical engineering or biomedicine who will continue with studies in biomaterials and tissue engineering.

The course covers the major classes of materials used in medicine, such as metals, ceramics, polymers, and composites. Emphasis is placed on structure, composition, mechanical properties, analytical methods, surface vs. bulk properties and degradation mechanisms of each material group. Also covered are sterilization methods, and industry and regulatory standards required for implant materials. These aspects of biomaterials are further stressed in a site visit to a medical device manufacturer.

Journal clubs address current materials issues within the medical implant field. Each article is read, summarized and criticized during tutorial sessions. Emphasis is placed on the materials used, processing methods, characterization, and performance.

For the group projects, each group of students will dive deeper into one of the articles from the Journal Club, addressing clinical needs, tissue physiology, alternative medical device strategies and other materials being used or developed for the application, and performance requirements. The application areas and alternative approaches will be presented orally by the students during a special session towards the end of the course.

Form of teaching

The course is based on a combination of lectures, Journal Club sessions, group project, and a site visit to a medical device company.

Language of instruction: English

Assessment

Course grades are based on the sum of grades from the Journal Club sessions, group project, individual grades from the group work, and written final exam.

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

In cases where a course has been discontinued or has undergone major changes, the student shall normally be guaranteed at least three examination occasions (including the ordinary examination) during a period of at least one year from the last time the course was given.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

Course evaluation

The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.