

Master's title: Physics of Materials

Semester : 3

Title of Unit: Methodology

Subject of courses: Biomaterials

Credits: 4

Coefficients: 2

Aim of courses:

This course is intended for Masters students whose aim is to reinforce their knowledge about biomaterials, especially as this type of material is intended for use in the human body.

For a good understanding of this course, we will begin with a general overview of biomaterials, including their areas of application. Definitions and descriptions have been described in this chapter and are essential for understanding the rest of the course.

Before describing the important used biomaterials, it is very important to know about bone tissue and the bone remodelling process. The student must also be familiar with the various methods of evaluating a biomaterial before its implantation into the human body.

An overview of the different types of biomaterials will be given, from the ancestors to the most recent materials used, giving the advantages and disadvantages of each type. The final chapters will be devoted to the most widely used biomaterials: hydroxyapatite, glasses and glass-ceramics.

At the end of the course, students will have an important provision enabling them to follow their progress in this field.

Chapter I: Overview of biomaterials

- 1- Introduction
- 2- Applications of biomaterials
- 3- Definitions

Chapter II: The bone/biomaterial interface and different types of biomaterials

- 1- Classification of biomaterials according to their interface with tissues
- 2- Different biomaterials
 - a- Metals and metal alloys
 - b- Ceramics
 - c- Polymers
 - d- Natural Materials

Chapter III: Biomaterial evaluation

1- In vitro tests

2- In vivo tests

Chapter IV: Bone tissue

1 - Different types of bone at macroscopic scale

2 - Composition of natural bone

3 - Mechanism of bone remodeling

Chapter V: Hydroxyapatite

1- Structure and chemical formula

2- The different hydroxyapatites

3- HA decomposition

4- Formation process of "bone like-apatite"

5- Factors influencing HA bioactivity

Chapter VI: Bioactive glasses

1- Definition and description of a glass

2- Vitrification

3- Different process of obtaining glass

4- Bioactivity of the glass

Evaluation methods : 66.67% Exam and 33.33% Continuous assessment

References:

1- F. Hulbert, J. C. Bokros, L. L. Hench, « Ceramics in clinical applications: past, present and future », High Tech Ceramics, Edition: P. Vincenzini, Elsevier, Amsterdam (1987).

2- D. F. Williams, « Definitions in Biomaterials », Second Consensus Meeting, Eur. Soc. Biomat., Edition: Elsevier, Chester, UK (September 1991).

3- J. Elliot, « Structure and chemistry of the apatites and other calcium orthophosphates », Edition: Elsevier (1994).

4- J. Zarzycki, « les verres et l'état vitreux », Edition : Masson, Paris (1982).

5- A. C. Pierre, « Introduction aux procédés sol-gel », Edition : SEPTIMA, Paris (1992).