ORT Braude College
Department of Mechanical Engineering

22481 Biomaterials

Course name: Biomaterials
Credit Points: 3.5
Course structure: Lectures – 2 hrs.
Tutorial – 2 hrs.
Laboratory – 1 hr.
Pre-requisites: Basic Chemistry
Thermodynamics
Strength of Materials
Textbooks:

- Biomaterials – an Introduction, 3rd edition, 2007
  Joon Park, R.S. Lakes,
  Springer
- Principles of Polymer Engineering, 3rd edition, 1988.
  N.G. McCrum, C.P. Buckley, C.B. Bucknall
  Oxford Science Publications

Course description:
An important element in modern medicine is the field of replacing defective natural body parts with man-made, artificial parts. These synthetic replacement materials may be categorized as either organic or inorganic materials, and can be integrated into the human body alongside healthy functioning organs, in order to improve human functionality. These materials can be termed Biomaterials.

The range of biomaterials is wide, including different phases, from liquids to solids. Biomaterials can also be categorized as metals, ceramics, polymers and composites. Polymeric materials are an important component of biomaterials, especially since their chemical character is similar to the human body's natural chemistry. As such, polymers can be used as implants to replace organs or components in short or long-term in-vivo mechanisms, as drug controlled-release vehicles, and other biomaterial applications.

Optimal application of artificial materials in the human body requires a thorough knowledge of the field of materials and their properties. Understanding of physical, chemical and biological properties of materials, in general, is the key to the optimal selection of biomaterials for the intended in-vivo human application. The Biomaterials course starts with a review of the basic science of atoms, molecules and chemical bonds, as a lead-in to a short study of metals and ceramics, and finally to an in depth study of polymeric materials.

Course chapters:

1. Introduction to materials
2. Atom structure - review
3. Chemical bond – metals
4. Chemical bond – Ionic and Co-valent
5. Chemical bond – ceramics
6. Polymer structure and polymerization
7. Polymers and plastics in the medical industry
8. Polymeric crystalline morphology
9. Polymeric amorphous morphology
10. Evaluation methods of materials
11. Rubbery state
12. Viscoelasticity
13. Material additives
14. Application for biomaterials

Course grading:

Homework assignments	10%
Application paper	10%
Laboratory reports	15%
Final exam	65%

Last Update: October 2017