

# BME203

## Course Syllabus

### 1. *Department:* Biomedical Engineering

*Number:* BME203

*Credit Hours:* 3

*Title:* Materials Engineering

*Required*

### 2. *Course Description:*

This course is an introduction to the fundamental physical principles governing the structure, processing, properties, and performance of metallic, ceramic and polymeric materials. Relationships are developed which define how the mechanical, physical and chemical properties of materials are controlled by microstructure and chemistry. Material failure modes, including fatigue, wear and corrosion, are developed with an emphasis on biocompatibility and the applications/performance of materials in the human body. Basic aspects of material biocompatibility at the cellular and protein levels are presented, leading into studies of the current and future applications of biomaterials

### 3. *Prerequisite(s):* CH 101; PY 205

### 4. *Textbook(s) and/or other required material:*

Materials Science and Engineering- An Introduction, 6th Ed.,  
W.D. Callister, John Wiley & Sons, 2003.

Reference: Biomaterials- An Introduction, 2nd Ed., J.B. Park and  
R.S. Lakes, Plenum Press, 1992.

Biomaterials- Principles and Applications, J.B. Park and J.D.  
Bronzino, CRC Press, 2003.

### 5. *Course objectives. By the end of this course, the student should*

*be able to: (use demonstrative verbs)*

Explain relationships between atomic bonding and atomic structure of materials; Explain relationships between the atomic and microscopic level structure of materials and their mechanical and physical properties; Understand and apply the basic failure modes of materials for specific applications; Design the processing of a material to achieve a desired set of properties; Design the chemistry and microstructure of a material for enhanced biocompatibility; Select materials for specific applications based on performance in the human body.

*6. Topics covered (give the number of lectures per topic, as well as the total number of lectures per semester):*

Total of 30 lectures (in parentheses): Introduction to Materials(1)Electronic Structure of Atoms, Atomic Bonding(1); Crystal Structures(1)Crystallography of Metallic and Ceramic Materials(1); Polymeric Microstructures(2)Defects in Solids(2); Phase Diagrams(1); Metallic Alloys(1)Thermal Processing(1); Mechanical Properties(1)Metals(1); Mechanical Properties(1)Ceramics and Polymers(1); Failure Mechanisms in Crystalline Solids- Fracture, Toughness, Fatigue, Wear(3); Failure Processes in Polymers and Corrosion(2); General Concepts for Biocompatibility at Protein and Cellular Levels(1); Metallic Biomaterials(2); Ceramic Biomaterials(2); Polymeric Biomaterials(2); Exams (3 plus final exam).

*7. Class/laboratory schedule (sessions per week and duration of each session):*

Three fifty-minute lectures per week.

*Date of preparation and person(s) who prepared this description:*  
Lesley H. Hubbard, December 30, 2003. Last edited on January 8, 2004. Last edited on February 9, 2004.