

September 18, 2003

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TO: The Engineering Faculty

FROM: The Faculty of the Department of Biomedical Engineering

RE: New Undergraduate-Level Course

The faculty of the Department of Biomedical Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

BME 202 Biomaterials

Sem. 2. Class 3, cr. 3.

Prerequisite: BME 205, ME 270

Corequisite: BME 206, BME 204

Covers the fundamentals of materials science and engineering concepts in a biological application context. Crystal structure, deformation of materials, characterization of materials, and performance of materials as implants. Integrated biological topics include bone physiology/anatomy, cells of bone, cell structure, and protein-mediated cell attachment. Emphasizes the unique biological criteria which must be considered when designing synthetic materials for implants.

Reason: Introducing students to the wide range of materials and properties which can be used to interact with physiological systems in a biomedical engineering context is important to understand and to develop implantable medical devices.

George Wodicka
Professor and Head

Supporting Documentation:

1. Level: Undergraduate – sophomore year
2. Course Instructor: Thomas J. Webster
3. Course Outline:

Topics in orderLectures**Structure (10 lectures):**

– Atomic bonding (1 lecture) / Crystal structure (2 lectures)	3
– Atoms of the same size / different size (1 lecture each)	2
– Imperfections in crystalline structures	3
– Definition of metals / ceramics / long-chain molecular compounds / polymers / Composite material structure	2

Processing (6 lectures):

– Forging, rolling, extrusion, drawing, cold-working / Strengthening grain boundaries	3
– Strain aging / Fiber and Martensite strengthening / Annealing and sintering / Strengthening of polymers and elastomers	3

Characterization (16 lectures):

– Stress-strain behavior / Mechanical failure / Tension, compression, and bending tests	3
– Hardness, Torsion, Fracture toughness, and Fatigue testing	2
– Viscoelasticity	2
– Phase diagrams, Surface and Thermal Properties	3
– Electrical and Optical properties, X-ray absorption	3
– Density, Porosity, Acoustic and ultrasonic properties, and Diffusion	3

Biological Applications (9 lectures):

– Bone biology/physiology, Tissue response to implants	3
– Tissue response to implants (cont.), Metallic and Ceramic implant materials	3
– Polymeric implant materials, Biological (natural) and Composite materials	3

EXAMS

3

Total

44

4. Text:

Ratner BD, Hoffman AS, Schoen FJ, Lemons JE: Biomaterials Science: An Introduction to Materials in Medicine. Academic Press, New York, 1996.

5. Grading: based on exams, homework, quizzes, and computational assignments.