UMBC UGC Change in Existing Course: ENME489 Special Topics in Mechanical Engineering: Biomaterials

Date Submitted: 2/09/16 Proposed Effective Date: Fall 2016

	Name	Email	Phone	Dept
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COURSE INFORMATION: (please provide all information in the "current" column, and only the information changing in the "proposed" column)

change		current	proposed
☒	Course Number(s)	ENME489	ENME476
☒	Formal Title	Special Topics in Mechanical Engineering: Biomaterials	Biomaterials
☒	Transcript Title (≤30c)	Special Topics in Mechanical Engineering: Biomaterials	Biomaterials
☒	Recommended Course Preparation	ENME220	ENME220 & ENME301
☐	Prerequisite **NOTE:** Unless otherwise indicated, a prerequisite is assumed to be passed with a "D" or better.	You must have completed all 300 level ENME courses with a grade of "C" or better and have senior standing with a 2.0 or better GPA.	You must have completed all 300 level ENME courses with a grade of "C" or better and have senior standing with a 2.0 or better GPA.
☐	Credits	3.0	3.0
☒	Repeatable?	☒ Yes ☐ No	☐ Yes ☒ No
☐	Max. Total Credits		**Max. Total Credits:** This should be equal to the number of credits for courses that cannot be repeated for credit. For courses that may be repeated for credit, enter the maximum total number of credits a student can receive from this course. E.g., enter 6 credits for a 3 credit course that may be taken a second time for credit, but not for a third time. Please note that this does NOT refer to how many times a class may be retaken for a higher grade.
☐	Grading Method(s)	☒ Reg (A-F) ☒ Audit ☒ Pass-Fail	☒ Reg (A-F) ☒ Audit ☒ Pass-Fail

CURRENT CATALOG DESCRIPTION:

Selected topics of current importance in mechanical engineering. Note: May be repeated for a maximum of nine credits with permission of student's advisor. Recommended Preparation: Senior standing and permission of department. This course is repeatable for a maximum of 9 credits or 3 attempts.

PROPOSED CATALOG DESCRIPTION (no longer than 75 words**):** leave blank if no changes are being proposed to the catalog description. NOTE: information about prerequisites should NOT appear in the catalog description.)

The structure and components (atoms) determine a material's properties. This course will study how the structure/composition of a material influences a material's properties, and how the structure/composition of a material can be changed to engineer or design a material's properties. The course will focus on building upon the materials science concepts first introduced in ENME 301, and applying those principals to engineering biomaterials - materials used to augment, enhance, or replace natural human biological functions. We will consider what we would like materials to accomplish in the human body, and examine how the structure/property relationships can be designed or exploited for the benefit of people. Although the examples we discuss in class will be focused on biological or medical applications of materials, the materials science fundamentals are equally applicable to any engineering discipline (for example, manufacturing, electronics, solid mechanics, etc.). In addition, because the field of biomaterials is intimately connected to creating devices and treatments for medical conditions, product development is an integral part of the field of biomaterials. Bringing a useful medical products to market often requires entrepreneurial process. In this class, we will also study the aspects of entrepreneurship relevant to biomaterial products.

RATIONALE FOR CHANGE:

This special topic has been offered consistently that it should have its own course number.

ENME 476
BIOMATERIALS
Fall 2016

Instructor: L.D.T. (Dr. T) Topoleski, ECS 225K, x5/3302, topoleski@umbc.edu

Class Meeting Times: Monday/Wednesday 4:00PM – 5:15PM, ITE 238

Office Hours: Monday after class (5:15-6PM), Thursday 11AM-12PM

Teaching Assistant: "Blackboard"

Text: none required; suggested reading

1) JC Anderson, KD Leaver, RD Rawlings & JM Alexander, *Materials Science* (4th ed), Chapman and Hall
2) RE Reed-Hill, R Ababschian, *Physical Metallurgy Principals* (3rd ed), PWS-Kent
3) PW Atkins, *Physical Chemistry* (4th ed), Freeman
4) JB Park and RS Lakes, *Biomaterials, An Introduction*, 2nd ed., Plenum
4) Previous text(s) in Materials Science, e.g. Askeland.

COURSE OBJECTIVES: The structure and components (atoms) determine a material's properties. In this course, we will study how the structure/composition of a material influences a material's properties, and how the structure/composition of a material can be changed to engineer or design a material's properties. The course will focus on building upon the materials science concepts first introduced in ENME 301, and applying those principals to engineering biomaterials - materials used to augment, enhance, or replace natural human biological functions. We will consider what we would like materials to accomplish in the human body, and examine how the structure/property relationships can be designed or exploited for the benefit of people. Although the examples we discuss in class will be focussed on biological or medical applications of materials, the materials science fundamentals are equally applicable to any engineering discipline (for example, manufacturing, electronics, solid mechanics, etc.). In addition, because the field of biomaterials is intimately connected to creating devices and treatments for medical conditions, product development is an integral part of the field of biomaterials. Bringing a useful medical product to market often requires entrepreneurial process. In this class, we will also study the aspects of entrepreneurship relevant to biomaterial products.

COURSE STRUCTURE: There are two lecture periods each week (Monday/Wednesday 4:00PM – 5:15PM). The lecture periods will be a combination of instructor's lectures and class discussion. Homework will be assigned in the form of reading material, written reviews, and problem solving. Undergraduates will perform a semester design project, designing an implantable device using the materials principals learned in class and through outside reading, and graduate students will write a term research paper. Those students taking the course for graduate level credit will earn their graduate experience from additions/amendments to the assignments, different assignments, different readings, and different expectations in their assigned work, and a separate discussion section.

COURSE SUBJECTS: The Course will cover several topics of importance in biomaterials. Those topics may include: Introduction: what is a biomaterial, and where are they used?, Tissue Engineering, Orthopaedic Biomaterials, Surfaces, including methods of analysis (e.g., Auger electron spectroscopy, Scanning electron microscopy), Mechanical behavior, i.e. failure, of biomaterials, Biocompatibility, and Mechanics of Materials in Biological tissue. We may change these topics as time and/or student interests indicate. Advanced topics in materials science will be introduced on an "as needed" or "just in time" basis. Examples include: Phase thermodynamics and equilibrium, Fracture Mechanics, Surface Physics and Chemistry, Advanced Mechanics of Materials. In addition, we will explore the entrepreneurial side of biomaterials, and we will invite guest lecturers with entrepreneurial experience.

Grading:

Homework	20%
Project	30%
Oral Presentation	10%
Midterm	20%
Final	20%
Total	100%

A Note of Caution on Written Reports: I expect all Written Reports (including Homework) to be submitted professionally and written in clear concise English. My experience indicates that this will require working on a report in considerable advance of the due date. If I deem any paper or project report unreadable or unacceptable from a writing stand point, I will return such project without grade. Students will then have an opportunity to rewrite the paper, and if it then becomes acceptable, it will be graded (less a late penalty).

NOTE on ACADEMIC INTEGRITY: By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community, in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating,

fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty and they are wrong. Academic misconduct could result in disciplinary action that may include suspension or dismissal. To read the full policy on academic integrity, consult the UMBC Student Handbook.