

BME 420 - Biomaterials and Biocompatibility

3 Credits, 3 Contact hours

Instructor: Bryan Pfister, Ph.D.

Course Coordinator: Bryan Pfister, Ph.D.

Textbook(s)/Materials Required:

Mechanics of Biomaterials, Fundamental Principles for Implant Design by Pruitt and Chakravartula, Cambridge University Press ISBN-13: 9780521762212

Description:

Biomaterials is an interdisciplinary field of material science, engineering mechanics and biology. Biomaterials not only must be tolerated by the human body, but often require the ability to integrate functionally. Therefore, biomedical engineers specializing in biomaterials need to be prepared for the selection, design and application of select materials. This course presents the student with the basic concepts and engineering fundamentals to understand the importance of biomaterials to medical science. Students will learn to approach and critically analyze biomaterial problems and applications and assess their clinical applicability, preparing them for both industry and academic research. Students will also be introduced to regulatory and ethical considerations that apply within and outside the experimental laboratory.

Prerequisites:

Math 222, BME 303, BME 304, MtSE 301

This is a required course for the Materials and Tissue Engineering Track.

Course Learning Outcomes (CLO):

9. Gain broad knowledge about biology and physiology of living systems and the science of materials to competently analyze the interaction of materials with the human body.
10. Be able to analyze the biocompatibility of biomaterial designs in regards to device/material function, degradation and toxicity and bodily responses including immunological response, cell/tissue interaction and effects on physiological functions.
11. Be capable of reading, comprehending and communicating the content of contemporary technical articles on biomaterials research and applications.
12. Be able to discuss the broader implications of the design on cultural, ethical, and economic factors.
13. Use knowledge gained to competently interpret current performances of contemporary and novel biomaterials and present recommendations for further study.

Student Outcomes:

Student outcome H - Broad education to understand effect of engineering solutions in a global, economic, environmental, and societal context.

Related CLO - 3

Student outcome J - Knowledge of contemporary issues.

Related CLO – 2, 3

Student outcome L - Apply bio/physio insight for BME application

Related CLO - 1

Student outcome O - Assess safety and effectiveness of interactions between living & non-living.

Related CLO – 1, 2

Course Topics: The chemical dynamic of living organisms, human cells and cellular dynamics, innate and adaptive immune response, foreign body response, the nature of solids, mechanical properties of materials, types of biomaterials: metals, ceramics, natural and synthetic polymers, polymer materials structure, physical behavior, and synthesis, biodegradable materials, medical devices: regulatory affairs and ethics, biomaterials in tissue engineering