

1. MME 3312 Biomaterials
2. 3 Credit Hours and 3 contact hours per week
3. *Assistant Prof. Binata Joddar, PhD*
4. An Introduction to Materials in Medicine, B.D. Ratner, A.S. Hoffman, F.S. Schoen, and J.E. Lemmons (Eds), Second or Third Edition Academic Press, San Diego, CA, 2004
5. Specific course information
 - a. This course provides an overview of digital and non-impact printing for biomedical applications. Their use in non traditional disciplines such as MEMS or bioengineering will be explained. By exploiting non-impact printing approaches and new materials, it has become possible to pattern and two- and three-dimensional structures that are biologically active. This course is intended to provide an introduction to this area. It covers established and new digital fabrication methods, new materials and processes that enable fabrication, and manufacture a broad range of biologically active devices, systems and structure.
 - b. MME2303
 - c. Required
6. Specific goals for the course
 - a. Learning Outcomes:
 - Understand fundamental concepts associated with biomaterials and their classification (Exam I)
 - Understand materials properties based on molecular structure (Exam I).
 - Apply materials selection criteria and stress distribution for hip implants and artificial blood vessel grafts (Exam I).
 - Understand biocompatibility between materials and the body (Exam II).
 - Understand various animal models for biomaterial implant testing (Exam II).
 - Collaborate on a biomaterial research project (Term Paper and Presentation).
 - b. Student Outcomes:
 - Outcome 1: An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics
 - Outcome 3: An ability to communicate effectively with a range of audiences
 - Outcome 4: An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
 - Outcome 6: An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions
 - Outcome 7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

7. Brief list of topics to be covered

- Introduction to Biomaterials, Structure and Function Relationships
- Classification: Metals, Ceramics, Polymers, Composites & surface design
- Metallic Biomaterials and effect of biological environment on metals
- Ceramics & effect of biological environment on metals
- Introduction to Polymers & polymers chemistry. Polymers: Effect of biological environment, case study, Hydrogels; Biomedical Polymers
- Biomedical Composites & Functional Materials
- Microscopy for Biomaterials Science
- Additive Manufacturing, Bio printing/ 3D organ printing
- Host Reactions to Biomaterials and their evaluation
- Applications of Materials in Medicine, Biology, and artificial organs
- Nano-biomaterials
- Practical aspects of Biomaterials