Department of Materials Science and Engineering
University of Maryland, College Park, Maryland

1. **ENMA 425 – Introduction to Biomaterials**

2. **Credits and contact hours – 3 credits.** The University of Maryland follows the Maryland Higher Education Commission's policies on "contact hours;" specifically, one semester hour of credit will be awarded for a minimum of 15 hours, of 50 minutes each of actual class time, exclusive of registration, study days, and holidays.

   Schedule: meets two 75 minute periods per week or three 50 minute periods three days a week

3. **Instructor's or course coordinator's name: Prof. Peter Kofinas**

4. **Text book, title, author and year:** Biomaterials Science – An Introduction to Materials in Medicine, 3rd Edition, edited by Buddy Ratner et al., Academic Press 2013. ISBN 978-0-12-374626-9.
   a. Other supplemental materials: Recommended: Biomaterials: The Intersection of Biology and Materials Science, J.S. Temenoff, A.G. Mikos, Pearson Prentice Hall 2008. ISBN 978-0-13-009710-1

5. **Specific course information**
   a. **Brief description of the content of the course (catalog description):** Examination of materials used in humans and other biological systems in terms of the relationships between structure, fundamental properties and functional behavior. Replacement materials such as implants, assistive devices such as insulin pumps and pacemakers, drug delivery systems, biosensors, engineered materials such as artificial skin and bone growth scaffolds, and biocompatibility will be covered.
   b. **Pre-requisites or co-requisites:** ENMA 300 and permission of the department.

   c. **Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program:** ENMA 425 is an elective course for Materials Science and Engineering majors.

6. **Specific goals for the course:**
   a. **Specific outcomes of instruction:** Students are familiar with the relationships between material type and properties and function in biomedical systems.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed in this course.

ABET A: Ability to apply mathematics, science and engineering principles.
ABET C: Ability to design a system, component, or process to meet desired needs
ABET H: The broad education necessary to understand the impact of engineering solutions in a global and societal context
ABET K: Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

7. Brief list of topics to be covered.

1. Introduction to Biomaterials Science
2. Types of Bonds, Microstructure
3. Bulk Mechanical Properties
4. Surface Properties and Surface Characterization
5. Polymers: Molecular Weight and Characterization of Molecular Weight Distributions
6. Step Polymerization: Polyurethanes, Polyesters, and Polyureas Biomaterials
7. Multifunctional Polycondensation: Silicones and Network Hydrogel Biomaterials
8. Radical Polymerization: Drug Delivery, Bone Cement, Contact Lenses and Implants
9. Glass Transition and Crystallization: Impact on Biomaterial Design
10. Metals and Ceramics: Stents, Orthopaedic, and Dental Biomaterials
11. Micropaticles and Nanoparticles
12. Blood Contacting Materials
13. The path from Biomaterial Conception to Clinical Product