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

1. **ENMA 300/ENME 382 – Introduction to Materials Engineering**

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 or three 50 minute periods per week

3. **Instructor's or course coordinator's name: Prof. Isabel Lloyd**

4. **Text book, title, author and year:** Callister, William D., Jr., Rethwisch, D.G., Fundamentals of Materials Science and Engineering: An Integrated Approach, 5th Ed., John Wiley and Sons, 2016. ISBN # 9781119325987.

5. **Specific course information**
   a. **Brief description of the content of the course (catalog description):** Structure of materials, phase transformations, corrosion and mechanical properties of metals, ceramics, polymers and related materials. Sustainability-informed materials selection and manufacturing processes for engineering applications.
   b. **Pre-requisites or co-requisites:** ENES 100 or permission of the department; Co-requisite: MATH241; Recommended: PHYS260/261.
   c. **Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program:** ENMA 300/ENME 382 is a required course for Materials Science and Engineering and Mechanical Engineering majors.
6. **Specific goals for the course:**
   a. **Specific outcomes of instruction**: The main objective of this course is to understand the process-structure-property relationships in engineering materials and use this information in materials selection for engineering design. A student completing this course satisfactorily should be able to:
      1. Identify features of crystal structures and their relationship to physical, mechanical, thermal, and chemical properties of materials.
      2. Understand the similarities and differences in the microstructure of metals, ceramics, polymers, biomaterials and nano-materials; and how these relate to their critical properties.
      3. Interpret features of binary phase diagrams and identify phase transformations

4. Become familiar with common manufacturing processes for metals, ceramics, and polymers; their effects on structure; and their impact on sustainability.
5. Identify process-structure-property relationships in engineering materials; and understand how these apply to materials selection in specific engineering problems. Consider sustainability in materials selection.
6. Address basic concepts of engineering ethics.

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 E: Ability to identify, formulate and solve engineering problems
ABET F: Understanding of professional and ethical responsibility
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. Process-Structure- Property Relationship and Materials Classification and Selection
2. Atomic Structure and Interatomic Bonding
3. Structure of Crystalline Solids (metals and ceramics)
4. Polymer Structures
5. Defects and imperfections in solids (metals and ceramics)
6. Diffusion (metals and ceramics)
7. Mechanical Properties
8. Deformation and Strengthening
9. Phase Diagrams and Phase Transformations
10. Remaining Deformation (Viscoelasticity) and Strengthening Mechanisms
11. Failure
12. Corrosion and Degradation of Materials