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

1. **ENMA 463 – Macroprocessing of Materials**

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

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

4. **Text book, title, author and year:** J.W. Evans and L.C. DeJonghe, The Production of Inorganic Materials, Macmillan, 1991.
   a. **Other supplemental materials:** J.S. Reed, Introduction to the Principles of Powder Processing, Wiley, 2nd. Ed., 1995. W.D. Callister and DG Rethwisch, Fundamentals of Materials Science and Engineering: An Integrated Approach 3rd or 4th Ed., John Wiley and Sons, 2008, (ENMA 300 text). R.A. Flinn and P.K. Trojan, Engineering Materials and Their Applications, 4th ed., John Wiley and Sons, 1995. The literature.

5 .**Specific course information**
   a. **Brief description of the content of the course (catalog description):** Processing of modern, bulk engineering materials. Raw materials, forming, firing, finishing and joining. More emphasis on metals and ceramics than polymers.
   b. **Pre-requisites or co-requisites:** ENMA300. Restriction: Junior standing or higher.
   a. **Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program:** ENMA 463 is an elective course for Materials Science and Engineering majors.

6. **Specific goals for the course:**
   a. Specific outcomes of instruction: The objective of this class is to examine the types of processes required to make discrete engineering components, especially polycrystalline ceramic and metallic components and engineering polymers. Processing and manufacturing are evolving areas so emphasis is placed on understanding what happens during process steps and the critical thinking skills necessary to effectively combine process steps in an overall process transferable to manufacturing. Students satisfactorily completing the class will:

1. Understand and be able to apply the design of experiments techniques to process development.
2. Understand the similarities between processing different classes of materials (metals, ceramics and polymers) as well as the differences.
3. Be able to identify the relationships between a processing method and properties and microstructure.
4. Be able to suggest approaches or process modifications to make a manufacturing process more ‘green’.
5. Be familiar with modern and more traditional approaches to process "discrete" or "bulk" products and materials via solid state and melt based routes

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 to design
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 G: Ability to communicate effectively
ABET H: The broad education necessary to understand the impact of engineering solutions in a global and societal context
ABET I: Recognition of the need for and an ability to engage in life-long learning.
ABET J: Knowledge of contemporary issues.
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
2. Design of experiments
3. Raw materials
4. Traditional Approaches
5. Solid freeform fabrication
6. Composites
7. Characterization: chemical, physical, microstructural