

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

1. **ENMA 440 – Nano Plasma Processing 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. Gottlieb Oehrlein**
  
4. **Text book, title, author and year:** Brian Chapman, Glow Discharge Processes: Sputtering and Plasma Etching, (J. Wiley, 1980), ISBN-10: 047107828X; M.A. Lieberman, and A.J. Lichtenberg, Principles of Plasma Discharges and Materials Processing. (John Wiley & Sons; 2nd Edition edition, 2005) ISBN-10: 0471720011
  
5. **Specific course information**
  - a. **Brief description of the content of the course (catalog description):** Sustaining mechanisms of plasmas are covered, especially low-pressure electrical gas discharges, fundamental plasma physics, sheath formation, electric and magnetic field effects, plasma-surface interactions in chemically reactive systems, plasma diagnostic techniques and selected industrial applications of low pressure plasmas.
  
  - b. **Pre-requisites or co-requisites:** Permission of the department.
  
  - c. **Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program:** ENMA 440 is an elective course for Materials Science and Engineering majors.
  
6. **Specific goals for the course:**
  - a. **Specific outcomes of instruction:** Student will know how to produce micro- and nanostructures using plasmas based on metals, polymers, and semiconductors.
  
  - 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 G: Ability to communicate effectively

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. Plasma Physics
3. Plasma Production and Substrate Biasing
4. Plasma Chemistry: Gas Phase and Surface Processes
5. Plasma Measurements (Diagnostics)
6. Basic Patterning: Approaches to Produce Micro- and Nanostructures
7. Plasma-Based Patterning of Conductors and Insulators
8. Plasma-Assisted and Directional Materials Synthesis; Nanofibers and Nanorods
9. Special Methods for Nanostructures and Nanomaterials
10. Charge-Free, Neutral Beam and Atomic Layer Processing
11. Energy Problem & Applications
12. Emerging Applications and Outlook