1. Course: **EMA 46145 Synthesis and Characterization of Semiconductor Materials**

2. Credits: 3 credits; Contact Hours: 3

3. Instructor: Stephen Pearton, Ph.D.

4. Text Book (optional): Fabrication Engineering at the Micro- and Nanoscale, Stephen A. Campbell, fourth edition, Oxford University Press, 2012, (ISBN-13: 978-0199861224, ISBN-10: 0199861226)

Other Supplemental Materials
Course Handouts: Provided by Instructor via web interface (lecture notes, solution sets from the text book and semiconductor videos)

5. Specific Course Information
    a. Course Description: Materials characteristics of common semiconductors, crystallography, principles of materials growth and characterization of semiconductors and related materials for electronic and photonic applications. Thermal oxidation of Si and bulk and epitaxial growth technologies with a special emphasis on CVD approaches for semiconductors, metals and dielectrics. Corresponding electrical, optical, structural and chemical characterization methods for evaluation and quality control are covered.
    b. Pre-requisite: None, but some knowledge of semiconductor physics is assumed
    c. Required Course
6. Specific Goals of Course
    a. Specific Outcomes of Instruction: To provide the student with a comparison of materials properties of semiconductor materials synthesized in both bulk and thin film form; growth/deposition methods such as molecular beam epitaxy, CVD and sputtering; kinetics and characterization of Si oxidation and an overview of characterization techniques used in the semiconductor industry. This knowledge is needed for pursuit of a professional career in the semiconductor industry.
    b. ABET Program Outcomes Supported by Course:
    Outcome a: an ability to apply knowledge of mathematics, science, and engineering.

    Outcome h: the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.

    Outcome i: a recognition of the need for life-long learning and the ability to adapt this to engineering practice.

    Outcome l: an ability to apply advanced mathematics, science, and engineering sciences, including solid state physics, to electronic materials systems and processes.

    Outcome n: an ability to work professionally in one or more of the areas of semiconductor synthesis.

7. Brief List of Topics to Be Covered

    a. Introduction to course (1 hour)
    b. Crystallographic properties of semiconductors (4 hours)
    c. Epitaxial growth of semiconductors (6 hours)
    d. Thermal oxidation kinetics of Si (4 hours)
    e. Chemical vapor deposition (9 hours)
    f. Physical vapor deposition (4 hours)
    g. Chemical cleaning of semiconductors (1 hour)
    h. Electrical properties of semiconductors (3 hours)
    i. Common characterization techniques for semiconductors and semiconductor devices (4 hours)

Numbers of hours are approximate. In addition, 4 hours are dedicated to exams or quizzes (2 exams and 2 quizzes, 1 hour each) and 2 hours are dedicated to course review.