The University of Texas at Tyler
Department of Electrical and Computer Engineering

EENG 5340.001 – Advanced Topics: Advanced Nano Materials and Nano Fabrication Technology

Syllabus

Catalog Description :

The purpose of this course is to provide an in-depth understanding of advanced nanomaterials, and the principles of nanofabrication technologies used to engineer structures at nanoscale. Students will explore the synthesis, characterization, and functional properties of nanomaterials with applications in electronics, energy, biotechnology, and sensing. In addition to theoretical knowledge, students will work collaboratively in teams to design, analyze, and propose innovative nano-enabled systems or devices through hands-on assignments and project-based learning.

Prerequisites: Consent of Instructor, EENG 3306, EE 4309

Credits: (3 hours lecture, 0 hours laboratory per week)

Text(s): Lecture notes, additional materials, and examples will be made available through Canvas. (**required**)
Books: Nanofabrication, Principles, capabilities and Limits- Zheng Cui-2nd edition

Additional Material: Not required

Course Coordinator: Md Masud Rana

Topics Covered: (paragraph of topics separated by semicolons)

Introduction to nano materials: classification of nano materials: Vacuum and plasma process: Thin film Deposition; Plasma etching process; Fabrication of nanostructures; Lithography; Electron beam lithography; Nanopatterning; Device fabrication: junction formation process; Device fabrication: oxide growth; Transistor and CMOS fabrication; Thin film Device fabrication.

Evaluation Methods: (only items in dark print apply):

1. Examinations / Quizzes
2. Homework
3. Report
4. Computer Programming
5. Project
6. Presentation
7. Course Participation
8. Peer Review

Course Objectives[2]: By the end of this course students will be able to:

1. Classify different types of nanomaterials and describe their unique physical, chemical, and electronic properties. [1]
2. Analyze vacuum and plasma systems used in nanofabrication, including their roles in thin film deposition and etching. [1,2]

3. Demonstrate understanding of thin film deposition techniques, such as chemical vapor deposition (CVD), physical vapor deposition (PVD), and atomic layer deposition (ALD). [1]
4. Describe and analyze plasma etching processes, including mechanisms, selectivity, and anisotropy. [1]
5. Explain the principles and methods used in nanolithography, including photolithography, nanoimprint lithography, and electron beam lithography. [1,2]
6. Design and evaluate nanopatterning approaches for high-resolution fabrication of nanostructures. [1,2,7]
7. Understand and model junction formation processes, including doping and diffusion techniques in semiconductor devices. [1,6]
8. Describe oxide growth techniques and analyze their application in nanoelectronics device fabrication. [1]
9. Analyze the process steps involved in transistor and CMOS fabrication, including the integration of materials and patterning techniques. [1,2]
10. Design basic thin film devices using appropriate materials and fabrication processes and evaluate their performance characteristics. [1,2,7]

[2]*Numbers in brackets refer to method(s) used to evaluate the course objective.*

Relationship to Program Outcomes (only items in dark print apply)[3]: This course supports the following Electrical Engineering Program Outcomes, which state that our students will:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics [1-4,9];
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors [5,6,7,10];
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions [8];
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. [9,10]

[3] *Numbers in brackets refer to course objective(s) that address the Program Outcome.*

Prepared By:	Prepared by Md Masud Rana	Date:	01 May 2025