

ECE 730 Topic 10

ADVANCED TECHNOLOGIES FOR SEMICONDUCTOR PROCESSING

(held with ECE 433 and NE 343)

| | |
|-------------|-------------------------|
| Term: | Spring 2024 |
| Instructor: | Prof. Siva Sivoththaman |

COURSE DESCRIPTION:

This course is intended to provide the students with the fundamentals, technological approaches, and practices in the fabrication of micro- and nano- electronic devices. Modern process technologies and design aspects for advanced devices will be covered along with the underlying theoretical concepts. Current device applications and future directions will also be discussed.

COURSE OUTLINE:

Vacuum and Plasma Processes

Introduction to vacuum, introduction to plasmas, collision processes in plasmas, electrical characteristics of plasmas, dc glow discharges, RF discharges.

Thin Films and Deposition Processes

Physical and chemical vapor deposition; Atomic layer deposition; Plasma processes; Molecular beam and liquid phase epitaxy.

Plasma Etching Processes

Role of etching in device fabrication; Modes of plasma etching; Etch chemistries; Reactive ion etching; Profile control in specific device structures.

Fabrication of Nanostructures

Top-down and bottom-up approaches; Zero-, one-, and two- dimensional structures; Nanoparticles and quantum dots; Nanotubes.

Optical Lithography and its limits

Exposure techniques; Sub-micron processing; Optical lithography and its limits.

Nano-patterning

Electron beam lithography; Nano-imprint lithography; Scanning probe techniques; Atomic scale manipulation.

'Transistor fabrication and CMOS

Processes for Junctions and Gate dielectrics; Basics of MOS transistor fabrication; CMOS Process sequence; Layout design; Material implications.

Fabrication of Thin film devices

Processes for thin film transistors; Circuit implementation; Display backplanes; Solar cells and photodetectors.

Nanoelectronic device fabrication

Trends in future fabrication options for nanoelectronic devices

MARKING SCHEME: (For ECE730 T10 students only)

Project/assignments: 40%, Final exam: 60%

OTHER ACTIVITY:

As part of the course, the students will take part in guided visits to nano- and micro- fabrication facilities on campus.

TEXT BOOK:

Course Notes

ACADEMIC INTEGRITY:

Every student must know, and fully abide by, the Academic Integrity Policy of University of Waterloo.

The information provided in the following link must be read, understood, and followed by every student:

<https://uwaterloo.ca/academic-integrity/integrity-students>