Solid State Electronics and Photonics Laboratory

ECE 5037

Credit Hours:
4.00

Course Levels:
Undergraduate (1000-5000 level)
Graduate (5000-8000 level)

Course Components:
Lecture
Lab

Course Description:
Introduction to laboratory techniques for semiconductor device fabrication including photolithography, oxidation, diffusion, chemical processes, reactive ion etching, and metallization; fabrication and measurements of visible light emitting diodes (LED) and GaN High Electron Mobility Transistor (HEMT).

Prerequisites and Co-requisites:
Prereq or concur: 3030, and acceptance in ECE, MSE or EngPhysics major; or Grad standing in Engineering, Biological Sciences, or Math and Physical Sciences.

Course Goals / Objectives:
- Be competent with the basic techniques for fabrication of LEDs and GaN HEMTs
- Be competent in applying knowledge learned in prerequisite semiconductor devices courses to fabrication of LEDs and GaN transistors, other semiconductor devices, and test structures
- Be competent in performing current-voltage characterization of semiconductor devices and test structures fabricated in lab
- Be competent in performing optical characterization of semiconductor devices and test structures fabricated in lab
- Be competent in extraction of device parameters from and analysis and interpretation of test results
- Be familiar with cleanroom procedures, and with safe use of the hazardous materials and equipment used in semiconductor device fabrication
Course Topics:
- Lab safety, overview of class
- Theory of LEDs and process overview
- Epitaxial Growth
- Theory of XRD and PL Characterization
- LED L-I optical characterization
- Wafer Cleaning
- Photolithography; photomask alignment, tolerances and layout
- Reactive ion etching
- Metal contact deposition - evaporation and sputter deposition
- Sheet resistance, four-point probe
- Rapid Thermal Anneal
- Overview of GaN HEMT Theory and Process
- Gate dielectrics and passivation
- Ion implantation
- Electrical testing of I-V characteristics
- Introduction to working in a cleanroom, initial silicon wafer characterization, wafer cleaning
- LED Processing and characterization
- GaN HEMT processing and characterization

Designation:
Elective