# lgplogo

## Course Information)

Course Title: Advanced Concepts in Electronic and Optoelectronic Devices

Course Number ECSE 4966

3 Credit Hours

Semester / Year Spring 2021

Meeting Days Wednesdays 9.00 am to 11:50 am

Room Location This course will be taught online using ZOOM. All lectures will be recorded and will be available to the students online.

RPILMS course site To be assigned

Prerequisites or Other Requirements ECSE 2210 or equivalent or basic physcs or materials science course

## Instructor

Full Name / Title: Michael Shur, Professor

Office location: CII 9111

Office Telephone Number: 518-276-2201

Office Hours; By appointment

Email Address: shurm@rpi.edu

## Teaching Assistant(s)

None

## Course Description

## The objective of this course is to introduce students to advanced semiconductor technology, develop understanding of the state-of-the-art advanced semiconductor technology including quantitative measures of current trends in Si CMOS and TFTs, develop knowledge of fundamentals of semiconductor physics required for understanding advanced device physics, and introduce and describe emerging semiconductor technology and its possible impact on systems.

This course is co-listed with ECSE 6210: students cannot receive credit for both this course and ECSE 6210.

## Course Text(s)

## : Lecture notes on the LMS siteSupplemental Reference: T. Fjeldly, T. Ytterdal, and M. S. Shur, Introduction to Device Modeling and Circuit Simulation for VLSI, John Wiley and Sons, New York, ISBN 0-471-15778-3 (1998)

## Course Goals / Objectives

## The objective of this course is to introduce students to advanced semiconductor technology, develop understanding of the state-of-the-art advanced semiconductor technology including quantitative measures of current trends in Si CMOS and TFTs, develop knowledge of fundamentals of semiconductor physics required for understanding advanced device physics, and introduce and describe emerging semiconductor technology and its possible impact on systems.

## Course Content

Emerging electronic devices

3 - 14 nm Silicon CMOS

Fin FET, Wrap-Around FET

Terahertz Transistors

Carbon Nanotube Transistors

2D and quasi-2D devices

Metamaterials, plasmonic crystals

Ballistic Transistors

Plasma Wave Terahertz Electronics

Hot Electron Transistors

Variable Threshold and Split Gate Transistors

Resonant Tunneling Transistors

Heterodimensional Transistors

Heterostructure and Tunneling Emitter Bipolar Transistors

Plastic and Organic TFTs for \ Giant Area Integrated Circuits on flexible substrates (Sensitive Skin)

Emerging photonic devices

Crystalline, amorphous, and organic solar cells

Terahertz Photonics

Deep UV Light Emitting Diodes and Lasers

Si photonics

Solid State Lighting

Optoelectronic Integrated Circuits

## Student Learning Outcomes

In light of the stated objectives students should be able to understand the state-of-the-art of advanced semiconductor technology, including quantitative measures of current trends in Si CMOS and TFTs, and develop knowledge of fundamentals of semiconductor physics required for understanding advanced device physics.

## Course Assessment Measures

Midterm presentation, class project abstract, midterm power point presentation slides

Final presentation power point presentation slides,

Term paper

Class Participation (asking and answering questions in class)

In comparison to ECSE 6210, the required term paper is shorter and will include review and discussion of published papers rather than original research

## Grading Criteria

Midterm presentation, class project abstract, midterm power point presentation slides 20%

Final presentation power point presentation slides 20%

Term paper 40%

Class Participation (asking and answering questions in class) 20%

## Academic Integrity

Student-teacher relationships are built on trust. For example, students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments that students turn in are their own. Acts that violate this trust undermine the educational process. The Rensselaer Handbook of Student Rights and Responsibilities and The Graduate Student Supplement define various forms of Academic Dishonesty and you should make yourself familiar with these. In this class, all assignments that are turned in for a grade must represent the student’s own work. In cases where help was received, or teamwork was allowed, a notation on the assignment should indicate your collaboration. Submission of any assignment that is in violation of this policy will result in a penalty of10% of grade. If you have any question concerning this policy before submitting an assignment, please ask for clarification. Collaborative or group work is encouraged where appropriate.

## Students with Disabilities

Rensselaer Polytechnic Institute strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on a disability, please let me know immediately so that we can discuss your options. To establish reasonable accommodations, please register with The Office of Disability Services for Students. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. DSS contact information: dss@rpi.edu; 518-276-819; 4226 Academy Hall.