MECE 5397/6397 Special Topic: Semiconductor Materials and Photonic and Electronic Devices

Required Textbook: Course materials in ppt format posted in Blackboard Learn

Recommended Reading: Students are encouraged (but not required) to read selected chapters of recommended reading books, as suggested during the class hours. Following is a list of recommended reading:

- B. G. Streetman and S. Banerjee, “Solid State Electronic Devices”
- R. F. Pierret, “Semiconductor Device Fundamentals”
- B. L. Anderson and R. L. Anderson, “Fundamentals of Semiconductor Devices”
- P. Bhattacharya, “Semiconductor Optoelectronic Devices”
- E. F. Schubert, “Light-Emitting Diodes”
- M.A. Green, Solar Cells: Operating Principle, Technology, and Systems Application”
- J. Nelson, “Physics of Solar Cells”

Recommended Prerequisites: MATH 1431 1432 and 2433 (Calculus); CHEM 1331 and 1332 (Fundamentals of Chemistry); .PHYS 1321 and 1322 (University Physics); MECE 3345 (Materials Science)

Grading Policy:

Exams	80%
Participation/Attendance	10%
Homework assignments and take-home exam	10%

Course Topics:

- Fundamentals of semiconductor materials
  - Semiconducting properties of materials
  - Group IV semiconductors
  - Group III-V semiconductors
- Junctions and diodes
  - p-n junctions
  - Other junctions
- Photonics Devices
  - Light-emitting diodes
  - Semiconductor lasers
  - Solar cells
  - Photodetectors
- Transistors
  - Field-effect transistors
  - Other transistors

- Special topics in semiconductor materials and devices for sustainable green technology applications

Learning Objectives:
Students who successfully complete this course are expected to meet the following course outcomes.

- Students will add to their knowledge base in the fundamentals of mechanical engineering and materials science and engineering, especially in the area of semiconductor materials and structures and their devices for photonic and electronic system applications, in part by gaining a greater understanding of key physical concepts, such as semiconducting properties of materials, semiconductor junctions, etc. Students will use this knowledge and understanding to identify and solve problems in semiconductor physics and device engineering. (ABET outcome e)
- Students will further develop their basic skills of problem solving and critical thinking by learning physical concepts in semiconductor and device physics and by applying this knowledge of mathematics, science, and engineering to efficiently solve problems related to materials and devices. (ABET outcome a)
- Students will learn how to design semiconductor heterostructures and devices based on data interpreted in order to meet desired needs within realistic constraints. (ABET outcome b and c)
- Students will learn broader impact related to environmental and social issues of green sustainable technology in semiconductor materials and photonic and electronic devices.
  Student will also learn state-of-the-art development of materials and devices in the field of green technology. (ABET outcome h and j)

Additional Statements:
Syllabus is subject to change.