MS4601 Principles of Semiconductor Devices

[Lectures: 26 hours; Tutorials: 13 hours; Pre-requisites: MS2018; Academic Unit: 3.0]

Learning Objective

This subject provides the basics of semiconductor devices for students who may wish to specialize in the field of semiconductor materials and devices at later years. They will learn about the principle of semiconductor devices. The major objective is to familiarize the students with the basic principles of operation of modern semiconductor devices such as p-n junction diode, light emitting diodes, MOS transistors, bi-polar transistors, solar cell, micro-wave devices. The topics covered earlier in subjects, such as, MS2018: Electronic and Magnetic Properties of Materials will be used as a foundation for teaching this subject. The knowledge gained through this subject will be useful in understanding other subjects, such as Fundamentals of Microelectronics Processing, LCD display, Photonic materials and devices, Failure Analysis and Reliability Studies of microelectronics.

Content

p-n Junction. Bipolar Junction Transistors**.** MOSFET and Related Devices. Microwave Diodes, Quantum-effect and Hot-electron Devices

Learning Outcome

Upon successful completion of the course, students will be able to:

- Understand the principle of semiconductor devices and operation mechanism.
- Design the basic devices of semiconductor for the specific application,
- Design p-n junction diodes and photonic devices,
- Calculate device characteristics of diodes, bipolar junction transistors, and field effect transistors,
- Design the bipolar and unipolar transistors,
- Measure the different parameters of semiconductor devices.
- Work in the micro-electronics company.

Textbooks/ References

1. S M Sze, *Semiconductor Devices - Physics and Technology*, Wiley, 2002
2. S. M. Sze, *Physics of Semiconductor Devices,* 2nd Edition, Wiley, 1981.
3. B. L. Anderson, *Fundamentals of Semiconductor Devices*, McGrawHill, 2005
4. N. G. Streetman, *Solid State Electronic Devices*, Prentice Hall, 1995
5. G. Parker, *Introductory Semiconductor Device Physics*, Prentice Hall, 1995
6. Michael Shur, *Physics of Semiconductor Devices*, Prentice Hall 1990