OPTI 404/504- Optical Spectroscopy of Materials

Course Description:

The course provides a survey of Optical Spectroscopic Methods and underlying phenomena for the study of materials.

Textbooks:

- Class notes

Recommended


Schedule

- Three lecture sessions per week.
- Two to three homework problems per week.
- Two one-hour class exams and a final examination.

Objectives

A high-level Program Outcome goal of this course is to produce graduates who can:

- Apply the fundamentals of mathematics, the physical and/or life sciences, and engineering principles; and
- Utilize modern engineering tools used in the profession.

Specific instructional goals are to introduce the underlying physical phenomena, methodologies, and instrumentation involved in optical spectroscopic techniques commonly used for the characterization of material optical performance and multi-length scale structure.

Students will:
• Develop a familiarity with the physics of spectroscopic analysis and light-matter interaction in this context, including wave propagation and diffraction, electronic and vibrational energy states, and selection rules;
• Develop an understanding of the basic operational principles of optical spectrometers/spectrographs; and
• Demonstrate an ability to compare and contrast different spectroscopic material probes in terms of the material properties characterized and instrumental or methodology requirements.

Topics

• Review of wave propagation in materials (3)
• Energy level structure and electronic transitions (6)
• Introduction to basic grating spectrometer operational principles and instrumentation. (3)
• Absorption spectroscopy (9)
• Emission spectroscopy (9)
• Scattering spectroscopy (9)