

SUNY Stony Brook
Department of Electrical and Computer Engineering

Course **Quantum Electronics I, ESE 515**
Professor: **Vera Gorfinkel, Ph.D.**
Text: **Principles of Lasers by Oracio Svelto, 5th edition, ISBN 978-1-4419-1301-2**

Course Description

Physics of lasers; Topics include introduction to laser concepts; Interaction of radiation with atoms and ions; Energy levels, Radiative and non-radiative transitions in molecules and semiconductors; Ray and wave propagation through optical media; Continuous wave operation; Solid state and semiconductor lasers.

Course Objectives

The course intends to give students a broad understanding of physical phenomena and devices based on interaction of light with matter. Students will also be trained for literature study and critique, oral presentation, problem formulation, solution development, and formal writing.

Grading principles:

Class attendance (30%), Midterm test (30%), Final Project and Presentation (40%).

Student Responsibilities

Each student is expected to:

- Complete assigned readings and homework.
- Participate in classroom activities,
- Successfully complete midterm and final exams.

AGENDA

1. **Introduction to laser concepts**
2. **Interaction of radiation with atoms and ions**
 - 2.1. Absorption, stimulated and spontaneous emission
 - 2.2. Einstein formula for spontaneous emission
 - 2.3. Spectral line broadening
3. **Energy levels, radiative and non-radiative transitions in molecules and semiconductors:**
 - 3.1. Molecules
 - 3.2. Bulk semiconductors
 - 3.3. Quantum wells
 - 3.4. Quantum dots
4. **Ray and wave propagation through optical media**
 - 4.1. Geometric optics
 - 4.2. Wave reflection and transmission in dielectric media
 - 4.3. Fabry-Perot interferometer

5. Pumping Processes

- 5.1. Optical pumping
- 5.2. Electrical pumping

6. Continuous wave operation

- 6.7. Rate equations
- 6.8. Threshold conditions

7. Solid state and semiconductor lasers

Disability

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, 128 ECC Building (631) 632-6748. They will determine with you what accommodations are necessary and appropriate. All information and documentation are confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information, go to the following web site: <http://www.ehs.sunysb.edu> and search Fire Safety and Evacuation and Disabilities.

Academic Honesty

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at <http://www.stonybrook.edu/uaa/academicjudiciary/>

Conduct

The University at Stony Brook expects students to maintain standards of personal integrity that are in harmony with the educational goals of the institution; to observe national, state, and local laws and University regulations; and to respect the rights, privileges, and property of other people. Faculty are required to report disruptive behavior that interrupts faculty's ability to teach, the safety of the learning environment, and/or students ability to learn to Judicial Affairs.