



Course Code ECE-442	Course Title Principles of Lasers	ECTS Credits 6
Department Engineering	Semester Fall or Spring	Prerequisites ECE-342, PHYS-305
Type of Course Elective	Field Engineering	Language of Instruction English
Level of Course 1 st Cycle	Year of Study 4 th	Lecturer(s) Dr Marios Nestoros
Mode of Delivery Face-to-face	Work Placement N/A	Co-requisites None

Objectives of the Course:

The main objectives of the course are to:

- present the basic principles of laser operation making use of the background knowledge from electromagnetic theory and quantum physics
- present technological issues behind laser construction
- describe properties of different types of lasers and their application areas.

Learning Outcomes:

After completion of the course students are expected to be able to:

- Identify the mechanisms of absorption and emission of electromagnetic waves
- Present and analyze the necessary and sufficient conditions for laser operation
- Quantify the spectral broadening mechanisms in lasers
- Model cavity effects using a software like MATLAB or C
- Analyze the different modes of laser operation
- Analyze the propagation of laser beams in free space
- Identify the various types of lasers and analyze their characteristics

Course Contents:

- Introduction. What is Laser and what are the applications.
- Review of discrete energy levels of matter.
- Radiative and non-radiative transitions between energy levels.
- Spontaneous emission and natural emission linewidth.
- Stimulated emission; Gain and absorption profiles of matter. Population inversion and lasing conditions.
- Laser cavity modes and stability in laser cavities (ABCD matrix).
- Propagation characteristics of lasers beams
- Q-switching, mode-locking and pulse shortening techniques
- Applications of lasers in science and engineering

Teaching Methods:

Lectures

Assessment Methods:

Homework and/or Projects, Mid-Term, Final Exam.

Required Textbooks:

Authors	Title	Publisher	Year	ISBN
W. T. Silfvast	Laser Fundamentals	Cambridge University Press	2004	978- 0521833455

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Christopher C. Davis	Lasers and Electro- optics: Fundamentals and Engineering	Cambridge University Press	2006	978- 0521484039