UNIVERSITY of NICOSIA

Course Syllabus

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

Course Objectives:

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 Content:

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

Learning Activities and Teaching Methods:

Lectures, and directed self-study

Assessment Methods:

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

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Laser Fundamentals (2nd edition)	W. T. Silfvast	Cambridge University Press	2012	978-0511616426

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Lasers and Electro-optics: Fundamentals and Engineering (2e)	Christopher C. Davis	Cambridge University Press	2014	978-0521860291