UNIVERSITÀ DI PAVIA

Anno Accademico 2020/2021

INDUSTRIAL LASER DESIGN

Anno immatricolazione	2019/2020
Anno offerta	2020/2021
Normativa	DM270
SSD	ING-INF/01 (ELETTRONICA)
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	ELECTRONIC ENGINEERING
Curriculum	Photonics
Anno di corso	2°
Periodo didattico	Primo Semestre (28/09/2020 - 22/01/2021)
Crediti	6
Ore	45 ore di attività frontale
Lingua insegnamento	English
Tipo esame	SCRITTO E ORALE CONGIUNTI
Docente	AGNESI ANTONIANGELO (titolare) - 6 CFU
Prerequisiti	Principles of electromagnetic theory, geometric and wave optics, optical and optoelectronic components.
Obiettivi formativi	Laser operating principles are discussed in relation to specific laser systems and materials. The aim is to provide the student with the working knowledge to understand the most used laser systems and their tecnological evolution, as well as how to choose the most appropriate laser for a given application. In particular, the approach to solid-state laser design will be explained with some practical examples. Solid-state laser engineering involves today most of the professionals designing laser sources or optimizing specific industrial applications of lasers. Lastly, the main applications of industrial lasers are presented, as well as those of the rapidly emerging ultrafast laser family.
Programma e contenuti	·Continuous-wave laser oscillators: 4 levels and quasi 3 levels systems.

	Factors determining threshold and efficiency. · Optical resonators: Gaussian beams and ABCD techniques. Stable resonators. Beam quality. Unstable resonators. · Techniques for controlling the emission spectrum. · Most important industrial lasers: Solid-state lasers. Fiber lasers. Semiconductor lasers, electrically and optically pumped. Other lasers of practical interest. · Nanosecond and sub-nanosecond pulsed operating regimes: Q-switching at low and high frequency. Gain-switching. Cavity dumping. Switching devices. Mode locking: techniques and devices. Stability condition for passive mode-locking. Propagation in dispersing media with Kerr nonlinearity. Technology of ultrafast lasers (ps/fs). · Techniques for measurement of ultrafast pulses. · Example of design of a solid-state laser working in cw and in Q-switching mode. · Pulsed and cw laser amplifiers. · Solid-state sources with nonlinear frequency conversion: harmonic, parametric and Raman generation. · Industrial applications of high power lasers: marking, cutting, soldering, drilling, trimming, surface processing. · Industrial and biomedical applications of ultrafast lasers: micromachining, nonlinear microscopy.
Metodi didattici	Lectures (hours/year in lecture theatre): 45 Practical class (hours/year in lecture theatre): 0 Practicals / Workshops (hours/year in lecture theatre): 0
Testi di riferimento	Lectures notes (A. Agnesi)?. Further readings: ?O. Svelto: Principles of Lasers, Springer, New York, 2010
Modalità verifica apprendimento	The exam consists in a (typically) 30-min discussion of a laser project assignment (different for each student), developed by the student as a “homework” during 2-3 weeks period before the agreed exam date. Such discussion might offer the opportunity for general questions on concepts related to the specific project task, presented in the course.
Altre informazioni	The exam consists in a (typically) 30-min discussion of a laser project assignment (different for each student), developed by the student as a “homework” during 2-3 weeks period before the agreed exam date. Such discussion might offer the opportunity for general questions on concepts related to the specific project task, presented in the course.
Obiettivi Agenda 2030 per lo sviluppo sostenibile	Gli obiettivi