

SYLLABUS

Name: Applications of Laser (AESAu-E>SI7M-ALob24)

Name in Polish:

Name in English: Applications of Laser

Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science

Course for department: Silesian University of Technology

Default type of course examination report:

ZAL

Language:

English

Short description:

Course Objectives: The goal of the course is to provide students with a comprehensive understanding of the various applications of lasers in different fields and industries.

Course participants become familiar with fundamental principles and techniques of laser operation, as well as their practical applications in areas such as industry, medicine, research, and communication. The course serves as a foundation for more specialized courses, like Laser Material Processing, Laser Diagnostics, and Advanced Optical Systems.

Description:

ECTS: 2

Total workload: 50 (30 contact hours / 20 student's own work hours)

Lecture: 15h

Laboratory: 15h

Student's own work: preparation for classes

1. Introduction to Laser Safety: This lecture comprehensively introduces laser safety. It covers international and national safety standards. Students will learn about laser hazards, safety equipment, and proper handling procedures.
2. Introduction to Basic Optical Principles: The lecture starts with light propagation principles like reflection, refraction, and diffraction. It also explores the applications of optical fibers and the wave - particle duality of light in laser physics.
3. Laser Generation Principles and Common Lasers: This lecture focuses on laser generation principles, including population inversion. It analyzes laser system components and introduces common lasers such as gas, solid - state, and semiconductor lasers.
4. Applications of Lasers in the Measurement Field: In this lecture, the exploration of laser applications in measurement takes place. Laser rangefinders, interferometry, and Doppler laser velocimetry are introduced, along with their principles and applications in relevant fields.
5. Applications of Lasers in the Processing Field: The lecture is about laser applications in processing. It analyzes parameters of laser cutting, discusses the advantages of laser welding, and introduces laser marking techniques and their industrial applications.
6. Applications of Lasers in the Biomedical Field: This lecture focuses on laser applications in biomedicine. It studies laser surgery in ophthalmology, dermatology, and minimally - invasive surgeries. Laser - induced fluorescence and photodynamic therapy are also covered.
7. Applications of Lasers in the Information Technology Field: The lecture explores laser applications in IT. It explains fiber - optic systems and wavelength - division multiplexing in optical communication. Laser - based data storage and optical sensors are also introduced.
8. Applications of Lasers in the Frontier Scientific Research Field: Finally, this lecture introduces laser applications in frontier research. It covers ultrafast lasers in attosecond physics, laser - cooling of atoms, and laser - plasma interactions, along with their basic concepts and research prospects.

Bibliography:

Primary sources:

1. Chen J.B., Peng R.L., Principles and Applications of Lasers 4th edition), Publishing House of Electronics Industry, 2019.

Secondary sources:

1. Chen H.M., Zhao X.Y., Wang J.L., Principles and Applications of Lasers (4th Edition), Publishing House of Electronics Industry, 2019.

Learning outcomes:

1. In the course, students first learn about fundamental knowledge. This includes laser safety standards and regulations, basic optical principles like light propagation laws, the wave - particle duality of light, and laser generation principles with different laser types. Understanding these basics is crucial for further exploration. (K1A_W2)
2. The course focuses on diverse applications. In the measurement field, lasers are used in rangefinders, interferometry, and Doppler velocimetry. In processing, laser cutting, welding, and marking are covered. In biomedicine, laser-related surgeries and therapies are studied. In IT, fiber-optic communication and data storage applications are introduced. Additionally, frontier research applications such as ultrafast lasers and laser-plasma interactions are also discussed. (K1A_W2, K1A_U1)

Assessment methods and assessment criteria:

Research Report, Presentation

Course credits in various terms:

<without a specific program>			
Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	2	2024/2025-Z	