



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Laser Techniques and Measuring Equipment [S1FT2>TLiAP]

Course

Field of study

Technical Physics

Year/Semester

3/6

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

0

Other

0

Tutorials

0

Projects/seminars

0

Number of credit points

1,00

Coordinators

dr hab. Bogusław Furmann prof. PP
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Lecturers

Prerequisites

General knowledge of physics, mathematics and the basics of programming at the level achieved after five semesters of study in the field of technical physics. The ability to solve simple physical problems based on the acquired knowledge, the ability to obtain information from indicated sources. Understanding the necessity of self-training.

Course objective

To provide students with basic knowledge on the use of laser techniques in various scientific industrial, metrological, military and medical disciplines. Developing the ability to design laser systems with given parameters.

Course-related learning outcomes

Knowledge:

The student:

1. knows the current state of advancement and is familiar with the latest development trends in the field of nanotechnology, optoelectronics, bioelectronics, quantum engineering and computer simulations of physical processes

Skills:

The student:

1. has the ability to self-educate, is able to obtain information from literature, databases and other sources, interpret it and draw conclusions, formulate and justify opinions
2. is able to plan and carry out standard measurements, analyze and document the results of research on classical and quantum physical phenomena, on the macro, micro and nano scale; is able to identify and assess the importance of basic factors disturbing the measurement

Social competences:

The student:

1. understands the need and knows the possibilities of continuous learning - improving professional, personal and social competences; is aware of the need to seek the opinion of experts when solving engineering tasks beyond their own competences

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Method of assessment Assessment criteria

written exam: 3: 50.1%-70.0%

4: 70.1%-90.0%

5: from 90.1%

Programme content

Methods of influencing the basic parameters of lasers at the stage of construction and use. Application of laser techniques in basic fields of technology, medicine, metrology and military.

Course topics

1. Methods of shaping the spatial, temporal and spectral characteristics of light generated by a laser.
2. Methods of stabilizing laser operation, measurement of generation wavelength, generation of attosecond pulses.
3. Mechanisms of the interaction of laser radiation with living tissue, review of lasers used in medicine, lasers in ophthalmology, surgical laser lancet, laparoscopy, lasers in oncology, selective destruction of cancer tissue.
4. Laser analysis of environmental pollution, lidars.
5. Laser spectroscopy of atoms, ions and molecules in scientific research, linear and nonlinear spectroscopy systems. Laser cooling, quantum metrology.
6. Laser cutting of materials and welding, types of lasers used, required beam parameters, laser engraving and drilling holes, microtechnology.
7. Recording and reading information using a laser, laser printers, holography, methods of recording and reading holographic images, types of holograms.
8. Laser rangefinders. Distortion measurements, laser interferometry, anemometry, fiber optic gyroscope.
9. Military applications of lasers, images created using a laser beam, multimedia shows.

Teaching methods

Conversational lecture: multimedia presentation, simulations demonstrations, examples given on the blackboard, solving research problems.

Bibliography

Basic:

1. Materials from lectures on eKursy platform (in Polish).
2. R. Jóźwicki, "Laser technology and its application"(in Polish) , Publishing House, P.W., Warsaw 2009.
3. A. Dubik, "Application of lasers"(in Polish) , WNT, Warsaw 1992.
4. P. Fiedor, "Outline of clinical applications of lasers"(in Polish) , Ankar Publishing House, Warsaw 1995.
5. T. Kęćik, "Lasers in ophthalmology"(in Polish) , PZWL, Warsaw 1984.
6. W. Demtroder, "Laser spectroscopy"(in Polish) , PWN, Warsaw 1992.

Additional:

7. R. Jóźwicki, "Basics of photonic engineering" WNT, Warsaw 2008.

8. B. Ziętek, "Lasers", Nicolaus Copernicus University Publishing House, Toruń 2008.

9. W. W. Duley, "Laser Processing and Analysis of Materials", Plenum Press New York and London 1983.

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,00
Classes requiring direct contact with the teacher	17	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	8	0,50