COURSE DESCRIPTION CARD - SYLLABUS

Course name
Construction of research apparatus [S2ETI2>BAB]

Course

Field of study
Education in Technology and Informatics

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

2,00

Coordinators

dr hab. Bogusław Furmann prof. PP
boguslaw.furmann@put.poznan.pl

Lecturers

Prerequisites

Knowledge of physics, mathematics, electronics, mechanics, optics and vacuum technology on2nd degree studies in the field of Technical and IT Education. Skill solving technical problems based on the possessed knowledge, the ability to acquire information from indicated sources, the ability to make a technical drawing, ability to use CAD programs. Basic knowledge of the English language.Understanding the need to expand your knowledge and skills. Ability to cooperate within a small team.

Course objective

1. To acquaint students with the basic issues related to the construction and operation of devices research
2. Developing students' ability to apply knowledge to problem solving technical related to the construction and operation of research systems. 3. Developing students' ability to acquire knowledge independently.

Course-related learning outcomes

Knowledge:
1. A student who has completed the course has a general understanding of the construction and operating principles of selected measuring equipment
2. A student who has completed the course has the basic knowledge to design and present simple

research equipment in engineering graphics
3. A student who has completed the course knows the basic methods of constructing research equipment

Skills:
1. A student who has completed the course is able to determine the basic parameters of a measuring device relevant to a planned experiment and design a device with the specified parameters
2. A student who has completed the course is able to design simple measuring systems, appropriately selecting system components in the form of research devices and standards
3. A student who has completed the course is able to plan and conduct experiments to solve a specific physical problem and correctly process and interpret their results

Social competences:
1. A student who has completed the course is aware of the importance of their knowledge for solving problems related to the design of research equipment.
2. A student who has completed the course is able to propose innovative solutions to problems

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Form of evaluation
Assessment of knowledge and skills demonstrated during the written test on the basis of the number obtained assessment criteria/assessment: in accordance with the study regulations
Assessment based on the draft in writing:
- assessment of the correctness of construction assumptions and the way of presenting the solution.
- assessment of unconventionality and originality in the adopted design solutions,
- assessment of independence and effectiveness in searching for information sources.
Assessment criteria/assessment: in accordance with the study regulations

Programme content

The course covers methods for measuring basic physical quantities and issues related to noise and noise reduction techniques in measurement systems. Modern methods of optical and laser metrology are discussed, including spectroscopy, fiber optic sensors, rangefinders, and mass spectrometers. The course also covers equipment used in quantum engineering, such as ion traps, atomic traps, and optical tweezers.

Course topics

Method and technique of measuring basic physical quantities.
2. Noise and disturbances in signal processing systems. Noise reduction techniques.
3. Metrology with the use of lasers. Rangefinders, fiber optic sensors, gyroscopes, anemometers
4. Advanced techniques of optical spectroscopy. Atomic absorption spectroscopy, spectroscopy Fourier, absorption and emission laser spectroscopy, optical tomography, double resonance optical-microwave.
5. Systems for laser spectroscopy with time resolution and nonlinear spectroscopy.
6. Apparatus for testing air pollution
7. Radiospectroscopy and microwave spectroscopy.
8. Particle selectors and mass spectrometers.
9. Basic devices of quantum engineering. Ion traps, atomic traps, optical tweezers

Teaching methods

1.Lecture: presentation illustrated with examples given on the board, solving problems.
2. Project: individual student project work, discussion.

Bibliography

Basic:
1. Building Scientific Apparatus, JH Moore, Ch.C. Davis, MA Coplan, Cambridge University Press 2009
2. Introduction to quantum metrology, W. Nawrocki, Publishing House Poznan University of Technology, Poznań 2007

3. Laser spectroscopy, W. Demtroeder, Polish Scientific Publishers PWN, Warsaw 1993
4. Optical instruments, F. Ratajczyk, Publishing House of the Wrocław University of Technology, Wrocław 2002
5. Electronics in a research laboratory, T. Stacewicz, A. Kotlicki, Polish Scientific Publishers PWN, Warsaw 1994
6. The art of electronics, P. Horowitz, W. Hill, WKŁ, Warsaw 2001
7. Introduction to magnetic resonance spectroscopy, J. Stankowski, W. Hilczer, Polish Scientific Publishers PWN, Warsaw 2005

Additional:
1. Practical Optics, N. Menn, Elsevier Academic Press, Boston 2004
2. Experimental Physics, Vol. 1 - 6, S. Szczeniowski, Polish Scientific Publishers PWN Warsaw 1983
3. Laboratory Physics, Vol. 1-2, F. Kohlrausch, State Scientific Publishers 1961
4. Technique of Physical Experiment, EvAngerer, H. Ebert, State Scientific Publishers 1964

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	5	0,00