

SYLLABUS

Name: Hazardous materials detection technologies - capabilities and limitations (WTCCXCSE-HMDT)

Name in Polish:

Name in English: Hazardous materials detection technologies - capabilities and limitations

Information on course:

Course offered by department: Faculty of Advanced Technologies and Chemistry

Course for department: Faculty of Advanced Technologies and Chemistry

Term: Winter semester 2024/2025 Year

Cordinator of course edition: dr inż. Edyta Budzyńska

Default type of course examination report:

Exam

Language:

English

Short description:

This course covers detection and identification technologies for existing and under-development hazardous substances, organisms, and objects. It discusses the principles, instrumentation, and context for applying various methods and technologies. Methods such as colorimetric chemistry, immunochromatography, immunoassays, polymerase chain reaction, spectroscopy, methods based on ionization and activation of materials, chromatography, mass spectrometry, and ion mobility spectrometry, and bulk detection technologies will be reviewed. Sampling problems and methods will also be briefly mentioned. The major emphasis of this course is on raising awareness of the capabilities and limitations of the technologies, which is essential for the proper selection of technology for a particular task and for the correct interpretation of the results obtained.

Description:

1. Properties of hazardous materials and specifics of their analysis / 4-hour
2. Sampling and preparation for detection and identification of trace amounts of substances / 8 hours
3. Laboratory analysis of samples containing dangerous substances / 8hours
4. Detection and determination of substances using field instruments / 8 hours

LABORATORIES

Students perform laboratory exercises on:

1. Laboratory analysis of samples containing traces of hazardous substances (chemical warfare agents) / 8 hours
2. Operation and applications of portable detection devices / 8 hours

SEMINARS

During the seminars, the following topics will be considered:

1. Techniques used in the analysis of hazardous substances / 8 hours
2. On-site analysis of trace amounts of hazardous substances / 8 hours

Bibliography:

Basic literature:

1. Hazardous Materials Air Monitoring and Detection Devices, Chris Hawley, Delmar/Thomson Learning, 2002 - 134, sygn. III-18299/TWB. 35
2. Field Detection Technologies for Explosives, Yin Sun, ILM Publications, 2010, 69492.

Supplementary literature :

3. Detection Technologies for Chemical Warfare Agents and Toxic Vapors, Yin Sun, Kwok Y. Ong; CRC Press, 2005
4. Hazardous Materials Characterization: Evaluation Methods, Procedures, and Considerations; Donald A. Shafer, Wiley 2005
5. Emergency Characterization of Unknown Materials; Rick Houghton; Taylor & Francis, 2007.

Learning outcomes:

W1/Has well-established and extended knowledge of the chosen specialty./K_W02

W2/Has the computer science and chemistry knowledge to effectively use commercial chemical packages and scientific information databases./K_W07.

W3/Has extended knowledge in the field of analytical chemistry, allowing theoretical justification of the choice of analytical method and determination of the chemical composition of substances or their mixtures./K_W11

W4/Knows classical and instrumental analytical methods, their analytical capabilities, and theoretical basis. Knows ways of checking the reliability of results from quantitative chemical analysis and statistical methods for evaluating the study results. Knows the tendencies development of analytical equipment./K_W12

U1/Can plan and perform experimental tests or observations in a chemical laboratory using occupational health and safety principles, safe handling of chemicals, and selection and disposal of chemical waste K_U03.

U2/Can use research and scientific equipment to analyze mixtures and environmental samples./K_U06

U3/Can find the necessary information in professional literature, databases, and other sources, knows essential scientific journals in the field of chemistry and can assess the reliability of the information obtained K_U10.

U4/Can interact with others in teamwork and take a leading role in teams./K_U16

K1/Recognizes the importance of knowledge in problem-solving cognitive and practical and expert consultation in case of difficulty solving the problem yourself. Can critically evaluate the content received./K_K01

K2/Is ready to fulfill social obligations, inspiring and organizing activities for the benefit of the environment and initiating action for the use of public interest./K_K02

K3/Understands the social aspects of the practical application of acquired knowledge and skills (especially in business) and the related responsibility./K_K04

Assessment methods and assessment criteria:

Students will be assessed based on their participation in the exercises, seminars, and written colloquium.

All laboratory exercises must be completed successfully to qualify for the written colloquium.

The learning objectives W1, W2, W3, W4 and skills U1, U2, U3, and U4 are assessed during written colloquium and laboratories.

The purpose of K1, K2, and K3 is assessed during seminars

Mode of study
full-time studies
Form of study
LLP Erasmus
Introductory subjects
1. General and inorganic chemistry – Knowledge of basic chemical laws 2. Organic chemistry – Knowledge of the basic properties of organic compounds and chemical reactions 3. Analytical chemistry and instrumental analysis – Knowledge of basic analytical techniques 4. Chemical sensors – General knowledge of converting a "chemical" signal into an electrical signal 5. Nuclear chemistry
Programs
Erasmus
Form of course / number of hours / final requirement
lectures - 28 hours / grade passing laboratories - 16 hours / passing seminars - 16 hours / passing
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ECTS balance
Activity / Load in hours 1. Participation in lectures / 28 hours 2. Independent study of the subject of lectures / 28 hours 5. Participation in seminars / 16 hours 6. Preparation for seminars / 16 hours 7. Participation in laboratories / 16 hours 8. Preparing for laboratories / 28 hours 9. Exam preparation / 36 hours Hours. / ECTS Total student load: 168/6 With 60/2 teachers involved Without teachers 108/4
Information on course edition:
Default type of course examination report:
Exam
Bibliography:
<i>missing bibliography in English</i>