GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Industrial analytics, PG_00068308		
Field of study			
Date of commencement of studies	February 2027	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study
Mode of study	Part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Polymer Technology -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Paulina Parcheta-Szwindowska	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	9.0	0.0	9.0	0.0	0.0	18

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	18	6.0	26.0	50

Subject objectives

Preparation for the selection and application of measurement techniques and instrumental analysis methods for testing materials used in industry, as well as for the detailed compilation, interpretation, and presentation of test results in the form of a technical report or presentation, taking into account the limitations of one's own knowledge, the need for expert consultation, and the planning of further professional development.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K01] understands the need for lifelong learning, is able to inspire and organize the learning process of others. is aware of his/her own limitations and knows when to turn to experts, is able to set priorities appropriately for the implementation of tasks defined by himself/herself or others	Is prepared to systematically develop competencies in industrial analytics and to organize their own learning process, in particular by identifying their own limitations, justifying the need to consult with an expert, and setting priorities for activities related to the completion of a research task.	[SK3] Assessment of ability to organize work
[K7_W02] knows measurement techniques and instrumental analysis used to study various material groups, including infrared spectroscopy, thermogravimetry, optical microscopy	Knows and understands the principles of operation, scope of application, and basic limitations of selected measurement techniques and instrumental analysis methods, in particular infrared spectroscopy, thermogravimetry, and optical microscopy, in the context of research on various groups of materials.	[SW1] Assessment of factual knowledge
[K7_U04] is able to conduct a detailed analysis of the obtained results and develop them in the form of a technical report or presentation, also in English	Is able to conduct a detailed analysis of materials testing results, using appropriate methods for compiling, interpreting, and presenting data in the form of a technical report or presentation, including in English.	[SU3] Assessment of ability to use knowledge gained from the subject

Subject contents

Course content – lecture

1. The role of industrial analytics in quality control, characterization, and evaluation of materials and manufacturing processes.
2. An overview of measurement techniques and instrumental analysis methods used to study various material groups.
3. Infrared spectroscopy (IR/FTIR)—principles of operation, sample preparation, spectrum interpretation, and examples of applications.
4. Thermogravimetry (TGA)—principles of measurement, interpretation of thermogravimetric curves, and evaluation of the thermal stability of materials.
5. Optical microscopy—principles of observation, sample preparation, image documentation, and evaluation of material structure.
6. Criteria for selecting an analytical method based on the type of material, the purpose of the test, and the expected information.
7. Sources of error, measurement uncertainty, method limitations, and the reliability of analytical results.
8. Compilation, interpretation, and presentation of test results; structure of a technical report, tables, graphs, and conclusions.
9. Organization of analytical work, documentation of tests, expert consultations, and development of professional competencies.

Course content – laboratory

1. Familiarization with safety rules, laboratory layout, and procedures for documenting laboratory tests.
2. Preparation of material samples for instrumental testing and determination of the purpose and scope of the analysis.
3. Recording and analysis of infrared spectra of selected materials; identification of characteristic bands and interpretation of results.
4. Conducting or analyzing a thermogravimetric measurement; interpreting the TGA curve and determining changes in sample mass.
5. Observing samples using optical microscopy; documenting images and describing observed characteristics.
6. Processing measurement data, compiling results in tables and graphs, and comparing test results.
7. Assessing the quality and limitations of the obtained results, identifying possible sources of error, and determining the need for expert consultation.
8. Preparing a technical report or presentation of research results, including in English.
9. Discussing the results, self-assessing competencies, and identifying priorities for further learning.

Prerequisites and co-requisites

Basic knowledge of chemistry, physics, materials science, and material properties, as well as familiarity with the basic principles of conducting measurements and analyzing data.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Evaluation of responses to research questions regarding the principles of operation, selection, scope of application, and limitations of measurement techniques and instrumental analysis methods.	60.0%	33.34%
Evaluation of the individual self-assessment form and the plan for further learning, taking into account the identification of limitations, the identification of situations requiring expert consultation, and the establishment of priorities for task completion.	60.0%	33.33%
Evaluation of a technical report on laboratory tests or a presentation of results, including data compilation, analysis, interpretation, and the formulation of conclusions.	60.0%	33.33%

Recommended reading

Basic literature	1. Skoog D.A., Holler F.J., Crouch S.R., Principles of Instrumental Analysis, Cengage Learning. 2. Stuart B., Infrared Spectroscopy: Fundamentals and Applications, Wiley. 3. Brown M.E., Introduction to Thermal Analysis: Techniques and Applications, Kluwer Academic Publishers.
Supplementary literature	1. Goldstein, J., et al., Scanning Electron Microscopy and X-Ray Microanalysis – Selected Topics in Microscopy and Materials Analysis. 2. Current standards, instrument manuals, and test procedures for infrared spectroscopy, thermogravimetry, and optical microscopy. 3. Current scientific publications and industry materials on analytical methods used in materials testing.
eResources addresses	

Example issues/ example questions/ tasks being completed	The Importance of Industrial Analytics – The Role of Analytical Testing in Quality Control, Material Characterization, and Process Monitoring. An Overview of Measurement Techniques and Instrumental Analysis Methods – Principles of Operation, Capabilities, and Limitations of Selected Methods. Infrared spectroscopy (IR/FTIR)—fundamentals of the method, identification of functional groups, and applications in the analysis of polymers and other materials. Thermogravimetry (TGA)—principle of measurement, analysis of changes in sample mass as a function of temperature, and evaluation of the thermal stability and composition of materials. Optical microscopy—microscope design and operating principles, sample preparation, and observation of microstructure and material defects. Selection of an analytical method based on sample type and test objective—comparison of the capabilities of various measurement techniques. Preparation of samples for instrumental testing—sampling, preparation, and storage of samples; the impact of sample preparation on the reliability of results. Measurement errors and uncertainty of results—sources of error; repeatability and reproducibility of measurements; limitations of analytical methods. Compilation and interpretation of test results—analysis of spectra, thermogravimetric curves, and microscopic images. Documentation of test results—structure of a technical report, data presentation, formulation of conclusions, and presentation of results in English.
Practical activites within the subject	Not applicable

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