



Subject card

Subject name and code	Certified reference materials, PG_00066098						
Field of study	Chemistry						
Date of commencement of studies	February 2026		Academic year of realisation of subject		2026/2027		
Education level	second-cycle studies		Subject group		Specialty subject group		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		2.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Analytical Chemistry -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Piotr Konieczka				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	0.0	30
	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	30		5.0		15.0	50
Subject objectives	To familiarize students with the role of reference materials (RM) and certified reference materials (CRM) in chemical metrology, ensuring measurement consistency and quality control of chemical analysis results. To develop the skills necessary for the proper selection, evaluation, and use of CRMs in the analytical process, particularly during method validation, estimation of measurement uncertainty, and evaluation of the validity of results. To prepare students to critically analyze reference material certificates and independently design a method for applying CRMs to solve a specific analytical problem. Translated with DeepL.com (free version)						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_W05] defines the principles of sustainable development, national and European conditions for environmental management, in the field of intellectual property protection and patent law		is familiar with the principles of producing, characterizing, certifying, and using reference materials and understands their role in ensuring the quality of chemical measurement results.		[SW3] Assessment of knowledge contained in written work and projects		
	[K7_U01] integrates and interprets information from literature, databases and other sources		is able to select the appropriate CRM for a specific analytical task, analyze its certificate, and use the CRM data to evaluate the validity of the method and the measurement result.		[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task		
	[K7_K01] is aware of the problems related to the profession of a chemist, is able to assess the effects of the activity performed		is aware of the importance of reliability, measurement traceability, and documented quality of chemical test results, as well as the need to critically evaluate the reference sources used.		[SK1] Assessment of group work skills [SK4] Assessment of communication skills, including language correctness		
	[K7_W02] identifies analytical techniques appropriate for solving specific analytical tasks – also in the production plant		knows and understands the basic concepts of chemical metrology related to reference materials, in particular RM, CRM, certified value, uncertainty, homogeneity, stability, and measurement traceability.		[SW1] Assessment of factual knowledge		

Subject contents	Course content – lecture 7 blocks of 2 hours each + 1 hour for summary/assessment: 1. Fundamentals of chemical metrology – 2 hours. The concept of a measurement result, measurement traceability, measurement uncertainty, standards and reference materials in chemical measurements. The role of reference materials in the quality assurance system. 2. Reference materials and certified reference materials – 2 hours. Definitions of RM and CRM. Types of reference materials. Matrix materials, pure substances, standard solutions. Property values and their uncertainties. 3. Production of reference materials – 2 hours. Production planning, material preparation, ensuring homogeneity, short- and long-term stability testing, transport, and storage. 4. Characterization and certification of CRMs – 2 hours. Characterization strategies, primary methods, interlaboratory tests, assignment of reference values, uncertainty budget for the certified value. 5. CRM Certificate and Material Selection – 2 hours. Interpretation of the certificate, scope of application, commutability, matrix compatibility, concentration level, validity period, minimum sample weight. Criteria for selecting CRMs. 6. Use of CRMs in the laboratory – 2 hours. Validation and verification of analytical methods, assessment of method performance and bias, quality control, control charts, estimation of measurement uncertainty. 7. Manufacturers, Availability, and Quality Requirements – 2 hours. Competencies of reference material manufacturers; ISO 17034 and ISO/IEC 17025 requirements; CRM databases and catalogs; examples of materials used in environmental analysis, food, materials, pharmaceuticals, and biological samples. 8. Summary / Final Assessment – 1 hour. Course content – project As part of the 15-hour project, the student: - defines the measurement problem and the requirements for the CRM; - searches for available reference materials; - establishes selection criteria and compares available CRMs; - analyzes the certificate for the selected material in detail; - evaluates the matrix compatibility, concentration range, uncertainty of the certified value, homogeneity, stability, and method of use; - designs the use of the CRM in the analytical procedure; - proposes a method for evaluating recovery/loading and the agreement of the obtained result with the certified value; - determines the role of the CRM in ensuring measurement consistency and/or estimating uncertainty; - prepares a project report and a brief presentation of the results.		
Prerequisites and co-requisites	Basic knowledge of analytical chemistry and instrumental analysis. Knowledge of the fundamentals of statistics and the interpretation of chemical measurement results. Ability to search for and critically analyze scientific literature and technical information in Polish and English.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	test - lecture	60.0%	40.0%
	project report	60.0%	60.0%
Recommended reading	Basic literature • ISO 17034, <i>General requirements for the competence of reference material producers.</i> • ISO Guide 35, <i>Reference materials — Guidance for characterization and assessment of homogeneity and stability.</i> • ISO Guide 30, <i>Reference materials — Selected terms and definitions.</i> • ISO Guide 33, <i>Reference materials — Good practice in using reference materials.</i> • ISO/IEC 17025, <i>General requirements for the competence of testing and calibration laboratories.</i> • Eurachem materials and guides on the quality of chemical measurements, measurement traceability, validation, and uncertainty.		
	Supplementary literature		
	eResources addresses		
Example issues/ example questions/ tasks being completed	Analysis of a CRM Certificate Selecting a CRM for an Analytical Problem Evaluation of CRM Suitability and Comparison Assessment of Result Conformity with the Certified Value Use of CRMs in Method Validation CRMs in Quality Control of Results Assessment of CRM Homogeneity and Stability Uncertainty of the Certified Value Measurement traceability of CRMs Criteria for Acceptance of Results Using CRMs		
Practical activities within the subject	Not applicable		

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