



Lodz University
of Technology

Study programme

Faculty:	Faculty of Chemistry
Major:	Chemistry in Forensics
Level of study:	second-cycle programme (magister)
Form of study:	full-time studies
Academic year:	2026/27

Table of contents

Basic information	3
Learning outcomes (in relation to the PQF)	4
Matrix of course modules in relation to learning outcomes and curriculum content	6
ECTS - subjects	11
ECTS indicators	13
Methods of verifying and assessing learning outcomes	14
Professional internships	15
Characteristics of the course	16
Education program	20

Basic information

Name of the field of study:	Chemistry in Forensics
Level of study:	second-cycle programme (magister)
Study profile:	general academic
Form of studies:	full-time studies
Duration of studies (number of semesters):	3
The number of ECTS points required to complete studies:	90
Total number of hours of classes:	1161
The number of ECTS points a student obtains as part of classes conducted with the direct participation of academic teachers or other persons conducting classes:	46
Professional title awarded to graduates:	magister
ISCED code:	0531
Language of study:	polish

Assigning the course to the disciplines to which the learning outcomes relate

Discipline	Percentage share
Chemical science	100%

Learning outcomes (in relation to the PQF)

No.	Learning outcome code	Learning Outcome Content	Reference to the universal characteristics of the first level of PRK	Reference to the second-level characteristics of the PRK, taking into account the second-level characteristics enabling the acquisition of engineering competences
1	2CHK1	Has in-depth knowledge of chemistry, in particular forensic chemistry, useful for formulating and solving complex tasks in line with the main development trends that are a response to contemporary dilemmas.	P7U_W	P7S_WG, P7S_WK
2	2CHK2	Has in-depth knowledge in the fields of mathematical statistics, multivariate data analysis methods, procedures for personal identification based on biometric features, and information technology tools used for the numerical and statistical processing of data applied in the collection and preservation of evidential material.	P7U_W	P7S_WG
3	2CHK3	Is familiar with instrumental analysis methods, techniques, tools, and materials used in solving complex problems in the field of forensic science.	P7U_W	P7S_WG
4	2CHK4	Is familiar with issues related to good laboratory practice, forensic medical analytics methodology, techniques for testing the toxicity of substances, standards for toxicological determinations, and the effects of toxic substances on human behavior.	P7U_W	P7S_WG
5	2CHK5	Understands the significance of DNA in evidentiary proceedings.	P7U_W	P7S_WG
6	2CHK6	Has knowledge of the mechanisms underlying human behavior influenced by various factors.	P7U_W	P7S_WG, P7S_WK
7	2CHK7	Knows and understands the principles of creating and developing various forms of entrepreneurship, occupational health and safety, as well as ethical and legal aspects in a global, economic, and social context.	P7U_W	P7S_WK
8	2CHK8	Is able to formulate and test research hypotheses, conduct appropriate chemical experiments, measurements and tests of forensic samples, including the use of advanced analytical methods, and solve unusual problems.	P7U_U	P7S_UW
9	2CHK9	Is able to obtain information from the literature, databases, and other appropriately selected sources, including those in a foreign language; she formulates and thoroughly justifies opinions on topics related to forensic chemistry in both Polish and a foreign language at the B2+ level, and identifies directions for further learning in order to enhance her own competencies and pursue continuous self-education.	P7U_U	P7S_UW, P7S_UK, P7S_UU
10	2CHK10	Able to work individually and in a team, undertake commitments and manage its work, applying the principles of occupational health and safety recommended in the laboratory environment and a systems approach, taking into account non-technical aspects, including environmental, economic and legal aspects.	P7U_U	P7S_UO

No.	Learning outcome code	Learning Outcome Content	Reference to the universal characteristics of the first level of PRK	Reference to the second-level characteristics of the PRK, taking into account the second-level characteristics enabling the acquisition of engineering competences
11	2CHK11	Is able to diagnose factors that modify human behavior by interpreting observed reactions in the context of knowledge about biological and psychological processes.	P7U_U	P7S_UW
12	2CHK12	Is prepared to formulate and present opinions on topics related to forensic chemistry, is aware of the importance of acquired knowledge in problem-solving, and recognizes the necessity of acting professionally and adhering to the principles of professional ethics.	P7U_K	P7S_KK, P7S_KR
13	2CHK13	Is aware of the responsibility for the tasks performed, including those related to teamwork, and is prepared to think and act in a creative and entrepreneurial manner with a sense of social responsibility.	P7U_K	P7S_KO

Matrix of course modules in relation to learning outcomes and curriculum content

No.	Course name	Program content	2CHK1	2CHK2	2CHK3	2CHK4	2CHK5	2CHK6	2CHK7	2CHK8	2CHK9	2CHK10	2CHK11	2CHK12	2CHK13
1	Forensic Chemistry	Fundamental issues in forensic chemistry, with particular emphasis on terminology and the historical development of the discipline. The significance of traces in forensic science, their classification, as well as the principles of proper collection and preservation of evidentiary material. The characteristics of selected types of forensic traces and the methods of their physicochemical analysis, including techniques applied in the examination of microtraces.	x		x					x		x			
2	Forensic Techniques	Issues related to forensic investigations, crime scene examination and the collection and preservation of evidentiary material, forensic databases, forensic examination of biological, chemical, and fingerprint traces, documents (across all media), and weapons, as well as the preparation of forensic expert opinions.	x		x					x		x			
3	Instrumental Methods in Forensic Analysis I	The application of selected techniques in forensic science, including fluorimetry, NMR spectroscopy, hyphenated techniques such as LC/NMR and LC/MS/NMR, TOF-SIMS, SEM-EDS, XRD, Raman spectroscopy and laser-based techniques, as well as LA-ICP-MS. Processes of material degradation and aging. Paper analysis. Special-purpose dyes. Radiometry and imaging methods in forensic science.			x					x		x			
4	Chromatographic Analysis GC	Classification of chromatographic methods. Fundamental principles of separation in partition chromatography and adsorption chromatography. Gas chromatography. Applications of techniques hyphenated with gas chromatography, including GC-MS, GCxGC/MS, GC-MS/MS, and GC-IR.			x					x					
5	Expert Evaluation of Crime Scene I	Document examination, advances in handwriting and document analysis, document forgery, determination of ink age, methods for the detection and preservation of explosive residues and GSR particles, analytical methods applied in forensic science, and principles of interpreting analytical results and drawing conclusions for judicial purposes.	x									x		x	x
6	Authentication of Products	The importance of product authentication in the context of a global market economy. The role of standardization. Methods applied to verify the origin and authenticity of products, as well as to validate manufacturing processes.	x							x					
7	Psychoactive Compounds - Chemistry and Detection	Classification of psychoactive compounds according to their chemical structure and mechanisms of action. The effects of psychoactive substances on behavior. Examples of addiction mechanisms and strategies for their treatment. Toxicity and selected metabolic pathways of psychoactive compounds.				x		x		x	x	x	x		
8	Chemometrics and Elements of Logic	Measurement uncertainties in analytical studies and limitations associated with small sample sizes. Inference based on statistical tests - practical exercises. Fundamentals of multivariate analysis, including principal component analysis (PCA). Methods of cluster analysis and classification.	x	x											

No.	Course name	Program content	2CHK1	2CHK2	2CHK3	2CHK4	2CHK5	2CHK6	2CHK7	2CHK8	2CHK9	2CHK10	2CHK11	2CHK12	2CHK13
9	Biometrics in Forensics	Metrics used in the evaluation of biometric system performance. An overview of applied biometric technologies. Determination of quantitative data representation (normalization and feature selection) and classification using minimum-distance methods.	x	x											
10	Foreign Language for Specialist Purposes	Grammatical and linguistic scope for scientific writing in chemical sciences – structures and conventions appropriate for academic texts. Preparation of presentations. Case study – scientific article – analysis and development.									x				
11	GLP Standards in the Analysis of Biological Material	Analytical methods and standards in forensic medical analysis, including toxicological and serohematological examinations, sampling procedures, and factors influencing analytical results. Principles of Good Laboratory Practice (GLP), GLP regulatory requirements, and their links to the broader GxP quality systems and manufacturer responsibility. Quality assurance systems in analytical laboratories, the organization of research units, documentation standards, as well as the planning and validation of analytical methods.			x	x	x			x					
12	Forensic Toxicology	Structure and properties of DNA and the human genome, with particular emphasis on genetic polymorphisms relevant to forensic and identification analyses. Methods of DNA analysis and sequencing, including PCR and STR profiling, as well as fundamental laboratory techniques used in forensic examinations. Fundamental concepts of toxicology, its historical development, factors determining toxicity, and the mechanisms of action, metabolism, and selected classes of toxic compounds affecting the human body.			x	x	x			x					
13	Instrumental Methods in Forensic Analysis II	The theoretical foundations and practical applications of selected instrumental methods, including FTIR and Raman spectroscopy, X-ray diffraction (XRD), X-ray fluorescence (XRF), and electron microscopy (SEM/TEM). Particular emphasis is placed on XRD techniques, phase analysis, the Rietveld method, and the use of spectroscopic and mass spectrometric methods in forensic science. The course concludes with an overview of analytical electron microscopy techniques and a final theoretical examination.													
14	Expert Evaluation of Crime Scene II	Traces and microtraces, including methods for their detection, collection, and analysis in forensic science and forensic toxicology. It covers the principles of analytical result interpretation and forensic reasoning, with emphasis on microtrace analysis in traffic accidents, violent incidents involving dangerous tools, document examination, analysis of unknown substances, and biological material collected ante- and post-mortem.													
15	Chromatographic Analysis LC	The theoretical foundations of chromatography, classification of chromatographic methods, and an in-depth overview of high-performance liquid chromatography (HPLC), including instrumentation, mobile and stationary phases, and separation optimization. Practical forensic applications of liquid chromatography, such as identification of psychoactive substances, sample preparation, chromatographic separations, and coupling LC with mass spectrometry (LC-MS).													

No.	Course name	Program content	2CHK1	2CHK2	2CHK3	2CHK4	2CHK5	2CHK6	2CHK7	2CHK8	2CHK9	2CHK10	2CHK11	2CHK12	2CHK13
16	Introduction to Offline Analysis of Digital Data Carriers	Digital forensics issues related to the preservation, storage, and analysis of data from digital storage media. Examination of file systems, operating systems, and application artifacts using data categorization, searching, and extraction techniques. Practical use of digital forensic tools in offline investigations of real-world data carriers.													
17	Biology and Genetics	Fundamental concepts of biology and molecular biology, including the structure and function of genetic material, genetic variability, and mechanisms of genetic information transfer and regulation in prokaryotic and eukaryotic cells. DNA handling techniques such as isolation, PCR, and electrophoresis, as well as basic microbiology, organismal development, inheritance, and the human immune system.													
18	Toxicology	Fundamental concepts of toxicology, including the definition and classification of poisons, their evolution in living systems, and the influence of the environment on organism metabolism. Major categories of toxic substances and basic analytical methods used for their identification, such as chromatography and mass spectrometry. Analyses of selected historical poisoning cases, highlighting the role of chemical analysis in forensic investigations.													
19	Forensic Analysis on the Nano Scale	Advanced microtrace analysis in forensic investigations, with particular emphasis on the selection and application of modern analytical strategies. Current trends in trace evidence analysis and the use of electrophoretic, chromatographic, immunochemical techniques, and mass spectrometry.													
20	Psychoactive Compounds - Pharmacology and Metabolism	The effects of psychoactive substances on the central nervous system, including CNS structure, synaptic function, receptors, and mechanisms of neural signal transmission. Fundamental concepts related to psychoactive substances, including addiction, and characteristics of major substance groups (opioids, psychostimulants, hallucinogens, cannabinoids, alcohol, and nicotine). Metabolism of psychoactive substances, their impact on human behavior, and an overview of psychotropic, antidepressant, sedative, and hypnotic drugs.													
21	Basics of Human Behavior	Fundamentals of neurotransmission and neurobiological mechanisms of behavior, emotions, aggression, stress, and decision-making, illustrated by classic experiments and clinical cases. Neurobiology of social relationships, motivation, reward, appetite regulation, pain, and eating behavior, with emphasis on the role of neurotransmitters, hormones, and brain systems. Neuropsychiatric disorders, perceptual and cognitive phenomena (memory, illusions, deception), ethical aspects of brain research, and the biological basis of preferences and choices.													
22	Scourges in History - a History of Diseases	A review of historical and contemporary disease entities, including their prevalence, the development of diagnostic and therapeutic approaches, and identification of causative agents. Social and civilizational aspects of disease occurrence, such as stigmatization, healthcare organization, and the impact of diseases on societal development. Selected infectious, parasitic, neurodegenerative, neoplastic, genetic, and civilization-related diseases, along with ethical aspects of research.													

No.	Course name	Program content	2CHK1	2CHK2	2CHK3	2CHK4	2CHK5	2CHK6	2CHK7	2CHK8	2CHK9	2CHK10	2CHK11	2CHK12	2CHK13
23	Interdisciplinary Applications of Forensic Sciences	Fundamentals of forensic science, forensic tactics and techniques, and forensic medicine, with particular emphasis on crime scene investigation and comprehensive forensic examinations. Event reconstruction based on fingerprint evidence, including its use in genetic analysis and identification of missing persons. Modern human identification techniques applied in contemporary forensic practice.													
24	Forensic Science-Research Capabilities of the Forensic Laboratory	Basic concepts of forensic science, forensic techniques and tactics, and the scope of analyses conducted in the forensic laboratories of the Regional Police Headquarters in Kraków. Direct and indirect identification methods, crime scene investigation, the role of the forensic expert, and techniques used to detect and identify perpetrators. Modern human identification techniques and practical issues.													
25	Forensic Opinion in a Criminal Trial	Basic concepts related to the role of the court expert, the legal basis for forensic opinions, and the scope and types of expert examinations. Principles of judicial evaluation of expert opinions, formal and ethical requirements for court experts, and their role in judicial proceedings.													
26	Forensic Technique and Tactics - Forensic Investigation of Crime Scene	The concept and scope of forensic science as an interdisciplinary field, including forensic techniques and tactics, and crime scene examination as a procedural activity. Collection and documentation of forensic evidence and reconstruction of events and cause of death based on crime scene and external body examination.													
27	Fundamentals of Business and Labour Law	The concept of entrepreneurship, forms of business activity, economic freedom, and basic methods of financing business ventures, including the role of a business plan. Fundamentals of labour law, sources of law, employment relationships, rights and obligations of employees and employers, working time, remuneration, leave, and occupational health and safety. Atypical forms of employment, self-employment, resolution of labour disputes, and employee rights related to parenthood. Protection of intellectual property.							x						
28	Monographic Lecture	Monographic lectures delivered by experts in the field, focusing on the latest trends, research, and techniques used in forensic analysis. Topics related to the identification and detection of art forgery.													
29	Diploma Project Laboratory	Conducting experiments related to the thesis topic, as well as analysis and interpretation of the obtained results.	x		x					x					
30	Diploma Seminar	Individual student presentations focused on the main issues related to their diploma thesis and participation in discussions on the presented content. A competency-based examination as a mandatory element of the diploma seminar, based on a case study and aimed at verifying the achievement of key programme learning outcomes in the area of competences. The examination conducted by a committee appointed by the Vice-Dean, with the result included in the final degree assessment.	x								x				

No.	Course name	Program content	2CHK1	2CHK2	2CHK3	2CHK4	2CHK5	2CHK6	2CHK7	2CHK8	2CHK9	2CHK10	2CHK11	2CHK12	2CHK13
31	Final Project	Preparation of a master's thesis . Under the guidance of a supervisor, independently deepening knowledge and skills leading to the preparation by the student of an original and coherent text that meets the formal and substantive requirements set for a thesis carried out at the Lodz University of Technology.	x								x				x

ECTS - subjects

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
1	Forensic Chemistry	2			2	
2	Forensic Techniques	4				
3	Instrumental Methods in Forensic Analysis I	6			6	
4	Chromatographic Analysis GC	2			2	
5	Expert Evaluation of Crime Scene I	2			2	
6	Authentication of Products	2			2	2
7	Psychoactive Compounds - Chemistry and Detection	2			2	
8	Chemometrics and Elements of Logic	2			2	
9	Biometrics in Forensics	4				
10	Foreign Language for Specialist Purposes	2				
11	GLP Standards in the Analysis of Biological Material	2		2	2	
12	Forensic Toxicology	2		2	2	
13	Instrumental Methods in Forensic Analysis II	6			6	
14	Expert Evaluation of Crime Scene II	2				
15	Chromatographic Analysis LC	3			3	
16	Introduction to Offline Analysis of Digital Data Carriers	2				
17	Biology and Genetics	3			3	
18	Toxicology	3			3	
19	Forensic Analysis on the Nano Scale	2			2	
20	Psychoactive Compounds - Pharmacology and Metabolism	2			2	
21	Basics of Human Behavior	4	4	4		

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
22	Scourges in History - a History of Diseases	4	4	4		
23	Interdisciplinary Applications of Forensic Sciences	1		1		
24	Forensic Science-Research Capabilities of the Forensic Laboratory	1		1		
25	Forensic Opinion in a Criminal Trial	2		2		
26	Forensic Technique and Tactics - Forensic Investigation of Crime Scene	2		2		
27	Fundamentals of Business and Labour Law	3	3		3	
28	Monographic Lecture	1				
29	Diploma Project Laboratory	4		4	4	
30	Diploma Seminar	2			2	
31	Final Project	20		20	20	

ECTS indicators

Name	Value
The total number of ECTS credits that a student must obtain through elective courses (amounting to no less than 30% of the total ECTS credits required to obtain the qualification corresponding to the given level of study)	33/90 (36.67%)
The total number of ECTS credits to be earned by a student through courses in the fields of humanities or social sciences	7
The total number of ECTS credits that a student must obtain from courses related to research conducted at the university, amounting to more than 50% of the total ECTS credits required to graduate from a given level of study	68/90 (75.56%)

Methods of verifying and assessing learning outcomes

Learning outcomes are verified and assessed systematically, using a variety of methods adapted to the specificity of the subjects and the nature of the intended learning outcomes. The following methods are used in particular:

- 1/ Written and oral examinations – to assess theoretical knowledge, the ability to analyze and synthesize information, and the ability to solve problems.
- 2/ Tests and colloquia – to enable ongoing assessment of progress, particularly in the acquisition of theoretical and practical material.
- 3/ Projects, laboratory exercises, and practical work – to verify the ability to apply research methods, work with equipment, interpret results, and collaborate in teams.
- 4/ Presentations, papers, and participation in seminars – to assess communication skills, argumentation, presentation of research results, and substantive discussion.
- 5/ Reports, statements, and written studies – to assess the ability to document the research process, analyze data, and formulate conclusions.
- 6/ Competency exam, thesis, and its defense – providing a comprehensive assessment of the achievement of learning outcomes in terms of knowledge, skills, and social competencies.
- 7/ Active participation in discussions, involvement in research projects and initiatives – enabling the assessment of independence, creativity, teamwork skills, and a research attitude.

Detailed methods for assessing learning outcomes are specified in the course specifications.

Professional internships

not applicable

Characteristics of the course

Graduate profile

Graduates in Forensic Chemistry possess in-depth knowledge of chemistry and its applications in forensic science and criminology, particularly chemical analysis, trace analysis, forensic analysis, and chemical analysis of evidence. They are familiar with modern instrumental techniques and methods used to identify, characterize, and interpret various samples, including microscopic, chromatographic, spectroscopic, mass spectrometric, and imaging techniques used in forensic laboratories.

The graduate has the ability to independently plan, conduct, and document analytical processes in accordance with good laboratory practice standards and procedures appropriate for law enforcement research. They can interpret chemical analysis results while taking into account their limitations, method validation principles, and formal requirements for handling evidence. They demonstrate the ability to prepare reports and expert opinions that meet the requirements of accredited laboratories and entities providing expertise for law enforcement agencies. Graduates understand the social, criminological, and legal conditions related to crime and are able to incorporate them into the interpretation of evidence. They possess the competencies necessary for teamwork and communication in an interdisciplinary environment. During their education, they develop analytical thinking skills, solving complex research problems, and teamwork.

The graduate's competency profile enables them to work in forensic, toxicological, and chemical laboratories, research and development units, and institutions performing specialized analyses for law enforcement and the justice system.

The relationship between the field of study and the university's strategy

The Forensic Chemistry program is fully aligned with the goals and priorities of the Lodz University of Technology Strategy for 2025–2030 (<https://p.lodz.pl/uczelnia/strategia-uczelni>), particularly in the areas of education, science and research, cooperation with the socio-economic environment, internationalization, staff development, infrastructure, and supporting talent and students.

Compatibility with the General Educational Goal

The Forensic Chemistry program pursues the goal of developing an educational model that prepares graduates for the dynamically changing needs of the socio-economic environment by educating specialists in chemical analysis and trace analysis for forensic laboratories, law enforcement agencies, and public safety entities, in accordance with the general goal of the Lodz University of Technology's Educational Strategy.

Improving the educational offering and modern teaching methods

- The curriculum for the Chemistry in Forensic Science program incorporates active teaching methods and the verification of learning outcomes that foster a proactive attitude among students (including problem-based and project-based approaches), which aligns with the specific objectives of the Lodz University of Technology Strategy for the continuous improvement of teaching quality and the development of methods that foster innovative education.
- Supporting research that addresses the challenges of the socio-economic environment. Research in the areas of chemical analysis of evidence, forensic toxicology, and instrumental methods supports the priorities of the Lodz University of Technology Strategy for research with high utility, interdisciplinarity, and social impact, preparing graduates for employment in institutions performing specialized analyses for law enforcement and the justice system.
- Developing mobility opportunities for employees, doctoral candidates, and students of Lodz University of Technology. Students of the Chemistry in Forensic Science program and the staff of the Lodz University of Technology Faculty of Chemistry regularly take advantage of opportunities to travel abroad.
- Conducting useful, socially and environmentally responsible research that supports a knowledge-based economy and fosters interdisciplinary research through the development of collaboration between disciplines and fields of science. Students have the opportunity to conduct research under the supervision of highly qualified experts and practitioners from the Institute of Forensic Research (IES) in Krakow, employees of the Forensic Laboratory of the Provincial Police Headquarters in Krakow (LK KWP), researchers from the Biochemistry and Neurobiology Team (ZBiN) at the Faculty of Materials Science and Ceramics of the AGH University of Science and Technology in Krakow, members of the Polish Forensic Society, and members of the Forensic and Toxicological Analysis Team of the Polish Academy of Sciences.
- Modernizing research infrastructure and developing a system for its rational use. Students of the Faculty of Chemistry at Lodz

University of Technology have access to specialized equipment and modern laboratories in the Alchemium building – the Magic of Tomorrow's Chemistry – as well as the infrastructure of the IES in Krakow, the KWP in Krakow, and the laboratories of the AGH University of Science and Technology in Krakow.

- Implementation of clear and fair principles of employment, remuneration, and career advancement, taking into account tolerance and equality policies. The recruitment process for the Faculty of Chemistry at Lodz University of Technology is based on the OTM-R policy – "Open, Transparent, Merit-Based Recruitment Process."
- Continuous improvement of academic teachers' competences in modern teaching methods, the current state of knowledge, technological developments, and scientific trends. Academic teachers involved in teaching in the Forensic Chemistry program actively participate in numerous training courses, improving their qualifications, including in modern teaching methods. They learn modern teaching methods from foreign specialists visiting the Faculty of Chemistry, and participate in teaching at foreign universities.
- Strengthening the talent management process by individualizing the education paths of undergraduates and doctoral students. Talented students can pursue studies within the IPS and IOZ programs.
- Supporting the scientific development of undergraduates and doctoral students, taking into account interdisciplinarity and internationalization; and Increasing student participation in research conducted at the university and intensifying students' practical experience outside the university. Students have the opportunity to participate in interdisciplinary research projects combining topics in chemistry, biology, medicine, and computer science. They can also participate in foreign trips and Erasmus+ exchange programs. Students are also co-authors of scientific publications with international reach.

The Chemistry in Forensic Science program implements the key assumptions of the Lodz University of Technology Strategy for 2025–2030 by: (i) aligning learning outcomes and teaching methods with the overall goal in the area of EDUCATION; (ii) integrating high-impact research and collaboration with the environment (IMPACT/SCIENCE); (iii) development of internationalization and mobility (INTERNATIONALIZATION); (iv) continuous improvement of staff competences; (v) effective use of infrastructure (INFRASTRUCTURE); (vi) systemic support for talents and students (TALENTS/STUDENTS), in line with the mission and vision of the university defined in the Strategy of Lodz University of Technology; source: Strategy of Lodz University of Technology for 2025–2030.

Educational objectives and employment and continuing education opportunities

The Forensic Chemistry program is designed to prepare graduates to independently and responsibly perform complex tasks in the areas of forensic chemistry, trace analysis, and forensic chemical analysis. The goal of the program is to develop in-depth theoretical knowledge and practical skills in modern instrumental methods, evidence analysis techniques, and research methodology used in contemporary forensic science, in line with current trends in the chemical sciences.

The program aims to educate specialists with the ability to formulate and test research hypotheses, conduct advanced physicochemical experiments, and interpret results using modern analytical and IT tools. The goal is also to prepare graduates to use statistical procedures, multivariate analysis methods, biometric techniques, and chemometric methods to support the analysis of forensic samples and forensic reasoning. A key goal of the program is to develop skills in evaluating evidence, selecting appropriate research techniques, integrating data from various sources, and formulating reliable and informed expert opinions. It also aims to prepare graduates for work in an interdisciplinary environment by acquiring competencies in forensic biology, toxicology, DNA analysis, trace identification, and understanding factors influencing human behavior, including the effects of psychoactive substances. The educational objectives also include developing the social competencies essential for work in forensic science: professional responsibility, ethical awareness, adherence to the principles of research integrity and professional ethics, specialized communication skills, and teamwork, including team leadership. The program is designed to prepare graduates to independently plan their own scientific and professional development, participate in an expert community, and undertake activities consistent with the principles of social responsibility.

Educational objectives are achieved by developing:

- knowledge, including specialized knowledge in forensic chemistry, analytical chemistry, toxicology, DNA analysis, chemometrics, biometry, and modern instrumental methods used in the analysis of evidence samples;
- experimental skills, including sample preparation, conducting trace analyses, using advanced research equipment (chromatography, spectroscopy, mass spectrometry, imaging techniques), as well as the proper selection and validation of analytical procedures;
- analytical competencies, enabling the development and interpretation of research results, the application of statistical and chemometric methods, the analysis of multivariate data, and the critical assessment of the reliability of obtained results;

- forensic reasoning skills, including formulating and testing hypotheses, integrating data from various sources, assessing the evidentiary value of trace evidence, and preparing expert opinions consistent with laboratory requirements and court standards;
- technical and digital competencies, including the use of IT tools, databases, biometric systems, and selected digital analysis techniques to support the interpretation of evidence;
- legal, ethical, and professional awareness, including knowledge of the principles of good laboratory practice, expert witness responsibility, evidentiary requirements, intellectual property protection, and professional ethics standards in forensic science;
- communication and linguistic competencies, including preparing reports and opinions, presenting research results, conducting substantive discussions, and using specialized chemical and forensic terminology in Polish and English;
- teamwork and organizational skills, including interdisciplinary collaboration, team management, taking responsibility for research tasks, and considering non-technical aspects (legal, environmental, social);
- willingness to pursue lifelong learning, including developing professional competencies, updating knowledge in forensic science and analytical chemistry, and consciously planning one's own scientific and professional development.

Graduates of this program are prepared to work in:

- forensic laboratories of the Police, Border Guard, National Revenue Administration, and other services responsible for public safety, analyzing physicochemical traces, microtraces, biological and toxicological materials, and substances of unknown origin;
- toxicological and analytical laboratories conducting research on biological and environmental materials and samples requiring advanced instrumental methods (spectroscopy, chromatography, mass spectrometry);
- research and development units, scientific centers, and expert centers involved in the development of new analytical methods, procedure validation, and research on chemical and material safety;
- specialized laboratories in the public and private sectors, including quality control laboratories, industrial laboratories, and institutions using chemical analysis to assess the authenticity, composition, and safety of products; • Justice institutions, including court expert offices, consultative bodies, and procedural bodies, where interpretation of chemical test results and preparation of expert opinions and expert reports are necessary;
- organizations responsible for sanitary-epidemiological, environmental, or health safety supervision, utilizing the analysis of toxic substances, contamination, hazardous materials, and chemical traces;
- laboratories specializing in data analysis, biometry, and digital techniques, utilizing statistical tools, identification systems, and multivariate analysis and chemometric methods;
- interdisciplinary teams combining chemical, biological, toxicological, IT, and forensic expertise, responsible for scientific research, expert opinions, consultations, or the implementation of new analytical technologies.

Graduates can continue their education:

- in third-cycle studies in chemical sciences and related areas, such as toxicology, forensic biology, health sciences, and safety sciences;
- in postgraduate studies in forensics, forensic toxicology, instrumental analysis, laboratory quality and certification, chemical safety, data analysis, and related specialized fields;
- in specialized courses and professional training, including the development of forensic expert competencies, the use of advanced analytical equipment, method validation, biometric analyses, IT tools, and chemometric methods.

Description of the process and outcome of consultations on the proposed study program with the socio-economic environment

The Forensic Chemistry program is closely linked to the needs of the socio-economic environment through active collaboration with institutions operating in the areas of public safety, justice, and chemical analysis. This collaboration supports the program's relevance, enables it to address current labor market needs, and provides students with exposure to professional practice.

Specialists from forensic laboratories and practitioners are involved in the educational process, including experts from the Forensic Laboratory of the Provincial Police Headquarters in Krakow, who conduct classes in forensic techniques, crime scene examination, trace identification, and the preparation of forensic reports. The presence of expert officers and court experts enables students to become familiar with current operational procedures, expert requirements, and work standards used in laboratory and procedural practice.

The program is also offered in collaboration with the AGH University of Science and Technology, whose specialists teach some classes in instrumental methods, toxicology, and trace analysis techniques. This provides students with access to the latest knowledge and experience derived from research and laboratory applications at external institutions.

The course includes courses taught by industry experts, including court experts in the fields of forensic science, document analysis, trace evidence analysis, toxicology, radiometry, and modern human identification techniques. This collaboration enables the development of practical skills in the methods used in forensic and forensic laboratories and provides students with direct contact with expert opinion-making practice.

Furthermore, the program includes components enabling the implementation of research projects and exposure to expert opinion-making practice through courses such as Expert Event Assessment, Forensic Techniques and Tactics, Forensic Expertise in Criminal Trials, and Forensic Science - Research Capabilities of the Provincial Police Headquarters Laboratory in Krakow. These courses support the development of competencies that address the real needs of public security institutions and forensic laboratories. Collaboration with the socio-economic environment therefore enables ongoing updating of the study programme, adaptation to the needs of employers, and provides students with the knowledge and skills required in the forensic science sector and industries related to chemical analysis, safety and evidence evaluation.

Description of competencies expected from a candidate applying for admission to studies

In accordance with the Admission Resolution.

The unit organizing education

Faculty of Chemistry

Education program

Semester 1

Course	Number of hours	ECTS points	Form of verification	Obligatory
Forensic Chemistry	Project work: 15 Lecture: 15	2	Exam	Obligatory
Forensic Techniques	Laboratory classes: 15 Project work: 15 Lecture: 30	4	Graded assignment	Obligatory
Instrumental Methods in Forensic Analysis I	Laboratory classes: 60 Project work: 30 Lecture: 30	6	Exam	Obligatory
Chromatographic Analysis GC	Laboratory classes: 12 Lecture: 8	2	Graded assignment	Obligatory
Expert Evaluation of Crime Scene I	Project work: 15 Lecture: 15	2	Graded assignment	Obligatory
Authentication of Products	Laboratory classes: 15 Lecture: 15	2	Exam	Obligatory
Psychoactive Compounds - Chemistry and Detection	Seminar: 2 Laboratory classes: 8 Project work: 2 Lecture: 8	2	Graded assignment	Obligatory
Chemometrics and Elements of Logic	Laboratory classes: 20	2	Graded assignment	Obligatory
Biometrics in Forensics	Laboratory classes: 30 Lecture: 30	4	Graded assignment	Obligatory
Foreign Language for Specialist Purposes	Tutorials: 30	2	Graded assignment	Obligatory
Elective Course 1		2	Graded assignment	Obligatory group
The student chooses 1 course from the group				
GLP Standards in the Analysis of Biological Material	Laboratory classes: 10 Lecture: 25	2	Graded assignment	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
Forensic Toxicology	Seminar: 5 Laboratory classes: 15 Lecture: 15	2	Graded assignment	Optional
Sum	455	30		

Semester 2

Course	Number of hours	ECTS points	Form of verification	Obligatory
Instrumental Methods in Forensic Analysis II	Laboratory classes: 45 Project work: 15 Lecture: 30	6	Exam	Obligatory
Expert Evaluation of Crime Scene II	Project work: 15 Lecture: 15	2	Graded assignment	Obligatory
Chromatographic Analysis LC	Laboratory classes: 15 Project work: 15 Lecture: 15	3	Graded assignment	Obligatory
Introduction to Offline Analysis of Digital Data Carriers	Laboratory classes: 15 Lecture: 15	2	Graded assignment	Obligatory
Biology and Genetics	Laboratory classes: 15 Lecture: 30	3	Exam	Obligatory
Toxicology	Laboratory classes: 15 Lecture: 30	3	Exam	Obligatory
Forensic Analysis on the Nano Scale	Laboratory classes: 15 Lecture: 15	2	Graded assignment	Obligatory
Psychoactive Compounds - Pharmacology and Metabolism	Lecture: 30	2	Graded assignment	Obligatory
Elective Course 2		4	Graded assignment	Obligatory group
The student chooses 1 course from the group				
Basics of Human Behavior	Seminar: 15 Lecture: 30	4	Graded assignment	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
Scourges in History - a History of Diseases	Seminar: 15 Lecture: 30	4	Graded assignment	Optional
Elective Course 3		1	Graded assignment	Obligatory group
The student chooses 1 course from the group				
Interdisciplinary Applications of Forensic Sciences	Lecture: 15	1	Graded assignment	Optional
Forensic Science-Research Capabilities of the Forensic Laboratory	Laboratory classes: 5 Lecture: 10	1	Graded assignment	Optional
Elective Course 4		2	Graded assignment	Obligatory group
The student chooses 1 course from the group				
Forensic Opinion in a Criminal Trial	Laboratory classes: 15 Lecture: 15	2	Graded assignment	Optional
Forensic Technique and Tactics - Forensic Investigation of Crime Scene	Laboratory classes: 15 Lecture: 15	2	Graded assignment	Optional
Sum	435	30		

Semester 3

Course	Number of hours	ECTS points	Form of verification	Obligatory
Fundamentals of Business and Labour Law	Lecture: 45	3	Graded assignment	Obligatory
Monographic Lecture	Lecture: 15	1	Graded assignment	Obligatory
Diploma Project Laboratory	Project work: 60	4	Graded assignment	Obligatory subjects to choose from
Diploma Seminar	Seminar: 30	2	Graded assignment + exam	Obligatory
Final Project	Diploma Thesis: 0	20	Pass	Obligatory subjects to choose from
Sum	150	30		