Laboratory Works in Chemistry

Educational subject description sheet

Basic information

Field of study Joint Bachelor in Sustainability	**Education cycle** 2025/26
Speciality Sustainable Physics & Chemistry	**Subject code** UJ.WPAJBSSPCS.880.16409.25
Organizational unit Faculty of Law and Administration	**Lecture languages** english
Study level first cycle (joint degree programme)	**Subject related to scientific research** Yes
Study form full-time degree programme	**Disciplines** Chemical sciences
Education profile General academic	**ISCED classification** 0588 Interdisciplinary programmes involving broad field 05
Mandatory obligatory	**USOS code**

Subject coordinator	Piotr Szwedo
Lecturer	Mohammad Alzeer

Period Semester 4	**Examination** graded credit **Activities and hours** Laboratory classes: 82	**Number of ECTS points** 5.0

Goals

C1	The course provides general chemistry laboratory skills and introduces students to sustainable and green chemistry laboratory work. The course is composed of four sections: safety lectures, inorganic chemistry, organic synthesis, and sustainable and green chemistry experiments.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the safety precautions when working in a laboratory setting	JBS_K1_W06, JBS_K1_W07	credit with grade
W2	the current trends in sustainable and green chemistry	JBS_K1_W03, JBS_K1_W04, JBS_K1_W06, JBS_K1_W07	credit with grade, report, findings
Skills – Student can:			
U1	demonstrate essential lab skills including the use of basic apparatus, handling chemicals, analytical precision and accuracy	JBS_K1_U03	credit with grade, report, findings
U2	implement syntheses according to instructions and construct the appropriate experimental set up	JBS_K1_U03	credit with grade, report, findings
U3	implement lab work on waste valorisation, water treatment, generation of biofuel, and greening chemical syntheses	JBS_K1_U02, JBS_K1_U04	credit with grade, report, findings
U4	analyse experimental results and outline findings both orally and in writing	JBS_K1_U03	credit with grade, report, findings
Social competences – Student is ready for:			
K1	to promote sustainability and sustainable practices in laboratory works	JBS_K1_K03, JBS_K1_K04, JBS_K1_K05	credit with grade, report, findings

Calculation of ECTS points

Activity form	Activity hours*
Laboratory classes	82
preparation for classes	20
exercises performance	10
report preparation	25

Student workload	Hours	ECTS
	137	5.0

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes
1.	Safety lecturers and best practices	W1
2.	Exp 1: Synthesis and characterization of chelate compound	W1, U1, U2, U3, U4, K1

No.	Course content	Subject's learning outcomes
3.	Exp 2: Calorimetry	W1, U1, U2, U4
4.	Exp 3: Gas burner and flame reactions	W1, U1, U2, U4
5.	Exp 4: Rate of reactions	W1, U1, U2, U4
6.	Exp 5: Strong and weak acids	W1, U1, U2, U4
7.	Exp 6: Solubility constant	W1, U1, U2, U4
8.	Exp 7: Galvanic cells	W1, U1, U2, U4
9.	Exp 8: Synthesis Acetylsalicylic acid (Aspirin)	W1, U1, U2, U4
10.	Exp 9: A Greener Approach to Aspirin Synthesis Using Microwave irradiation	W1, W2, U1, U2, U3, U4, K1
11.	Exp 10: Synthesis of p-methyl acetophenone	W1, W2, U2, U4, K1
12.	Exp 11: Synthesis of Ethyl propionate	W1, W2, U2, U4, K1
13.	Exp 12: Ultrasonic-Assisted Synthesis, Characterization, and Application of a Metal−Organic Framework in removal of organic pollutants from aqueous solutions	W1, W2, U1, U2, U3, U4, K1
14.	Exp 13: Sustainable Polymers and Waste Biomass Valorization; Synthesis and Characterization of Biobased Lactose Hydrogels and their application in removal of heavy metals from wastewater	W1, W2, U1, U2, U3, U4, K1
15.	Exp 14: Greening the synthesis of noble metal nanoparticles using plant extract-based reducing agents	W1, W2, U1, U2, U3, U4, K1
16.	Exp 15: Synthesis of waste-based heterogeneous catalyst and its application in the synthesis of biodiesel	W1, W2, U1, U2, U3, U4, K1

Course advanced

Teaching methods :

lecture, laboratories

Activities	Examination methods	Credit conditions
Laboratory classes	credit with grade, report, findings	Must pass the laboratory safety exam, prior to starting the laboratory work.Laboratory work reports, assignments, and synthesis forms. Written assignments and group discussions about selected topics.

Entry requirements

None

Literature

Obligatory

1. Lab manual, additional scientific articles provided during laboratory sessions

Effects

Code	Content
JBS_K1_K03	The graduate can consider different visions of the future and develop own evidence-based opinions in reference to the balance of values linked to economic development, social welfare, and environmental protection.
JBS_K1_K04	The graduate can critically assess and verbalize own competencies and skills related to different aspects of sustainability as well as their need for development.
JBS_K1_K05	The graduate can defend the importance of scientific data and methods as a basis for decision-making.
JBS_K1_U02	The graduate can present and report knowledge, methodologies, ideas, problems and solutions, clearly and comprehensively, in different forms destined for different audiences – including discussions and debates which require defending a substantiated opinion, as well as conversations in a foreign language at the CEFR B2 level.
JBS_K1_U03	The graduate can apply adequate methods and tools, including selected IT tools, to solve problems related to data collection, analysis, and management in the context of sustainability.
JBS_K1_U04	The graduate can plan and effectuate simple sustainability-related projects under supervision and in the context of personal lifelong learning, both individually and in a team, using appropriate transversal skills and taking shared responsibility for the outcome.
JBS_K1_W03	The graduate can give examples of sustainability-related dilemmas and hypothesize on the optimal course of action.
JBS_K1_W04	The graduate can identify sustainability-related problems specific to selected cultural, geographical, and political contexts.
JBS_K1_W06	The graduate can describe interconnections between various aspects of sustainability and identify their significance in the context of natural and social sciences, with a special focus on disciplines included in the selected specialisation track (law and politics; chemistry and physics; chemistry and biology; economics and geography; economics, management and engineering; humanities).
JBS_K1_W07	The graduate can apply the theory and methodology of disciplines included in the selected specialisation track to sustainability-related problems, taking into consideration practical limitations such as protection of intellectual property.