DESCRIPTION OF THE SAFE_ 09 MODULE IMPLEMENTED AS PART OF THE INTENSIVE FORM OF EDUCATION (IFoE)

Module Name	*Unconventional methods of managing plant waste materials*			
Language of Instruction	english			
Module Purpose	Lecture: introduction to the topic (importance of waste material utilization in green transformation), overview of current trends in nanoparticle synthesis, characteristics of waste materials (types, chemical and physical properties relevant to synthesis), methods of magnetic nanoparticle synthesis (green synthesis – environmentally friendly approaches), applications of magnetic nanoparticles in agriculture. Practical Exercises: Safety procedures, sample preparation from waste materials, extraction and reagent preparation, green synthesis proces, sediment centrifugation and calcination, analysis of magnetic properties of synthesized nanoparticles, examples of practical applications.			
Module Content				
Description of learning outcomes	Effect Symbol	Effect Name Methods	Verification and Documentation	Reference to Directional Effect Set
	KNOWLEDGE (graduate knows and understands)			
	W1	Explains the principles of technologies used in nanoparticle synthesis and their applications in industry and agriculture	Discussions	SAFE_W01
	W2	Assesses the quality and safety of the synthesis process and proposes innovative solutions	Discussions, worksheets	SAFE_W04
	SKILLS (graduate can)			
	U1	Plans and conducts the synthesis process using waste materials, considering environmental aspects	Lab report	SAFE_U01

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	U2	Presents experimental results and defends conclusions in discussion	Research presentation	SAFE_U02
	SOCIAL COMPETENCES (graduate is ready to)			
	K1	Demonstrates awareness of technological impact on the environment and applies principles of sustainable development	Discussions	SAFE_K01
	K2	Actively participates in teamwork and communicates with experts from various fields	Discussions	SAFE_K02
Module crediting method	Graded assessment			
ECTS credit balance (total, developing practical skills, from classes conducted using distance learning methods and techniques)	Number of contact hours/ECTS points		Number of non-contact hours/ECTS points	
	Lectures (hours 1 ECTS points 0,04) Classes (hours 2 ECTS points 0,08)		Reading literature (hours 1 ECTS points 0,04) Preparing a presentation (hours 0,05 ECTS points 0,02) Preparing for credit (hours 0,5 ECTS points 0,02)	
	Total contact hours 3 hr. 0,12 pt. ECTS		**Total non-contact hours 2 hr. 0,08 pt. ECTS**	
Staffing	Dr Eng. Małgorzata Góral-Kowalczyk			
Information on the infrastructure ensuring the implementation of learning outcomes	Laboratories equipped for nanoparticle synthesis and analysis, accessible to persons with disabilities. Integrated digital environment for conducting classes.			
Planned teaching methods	Lecture, laboratory exercises			

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Recommended reading list	Saquib, Q., Faisal, M., Al-Khedhairy, A. A., & Alatar, A. A. (Eds.). (2020). Green synthesis of nanoparticles: Applications and prospects. Springer. Chaudhari, H. N. (2024). Green Synthesis and Emerging Applications of Iron-Based Nanomaterials. Materials Research Foundations, 169. López-Ortega, A., & Roca, A. G. (Eds.). (2024). Magnetic Nanoparticles: Materials Engineering, Properties and Applications. Royal Society of Chemistry.

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