DESCRIPTION OF THE SAFE_11 MODULE IMPLEMENTED AS PART OF THE INTENSIVE FORM OF EDUCATION (IFoE)

Module Name	Refrigeration Processes in the Processing and Preservation of Agricultural and Food Products			
Language of Instruction	english			
Module Purpose	The aim of the module is to provide students with knowledge of refrigeration processes used in food and agricultural product preservation. Participants will understand how low temperatures affect the quality, structure, and shelf life of food, and will gain practical experience with cryogenic technologies in modern food processing.			
Module Content	The module covers the importance of refrigeration in maintaining food quality and extending shelf life throughout the cold chain. It discusses the application of refrigeration in postharvest treatment of agricultural products and refrigerated transport. Students will learn about types of refrigerants and their environmental impact, as well as various cooling and freezing technologies used in the agri-food sector. Special attention will be given to cryogenic preservation using liquid nitrogen, safety procedures, and practical applications in the food industry. The module also includes an overview of modern temperature control and automation systems, along with the sustainability aspects of refrigeration technologies.			
Description of learning outcomes	Effect Symbol	Effect Name Methods	Verification and Documentation	Reference to Directional Effect Set
	KNOWLEDGE (graduate knows and understands)			
	W1	Understands the principles and significance of refrigeration processes in food preservation.	test	SAFE_W02 SAFE_W03
	W2	Knows the effects of cryogenic technologies, including liquid nitrogen, on food quality and safety.	test	SAFE_W01 SAFE_W04
	SKILLS (graduate can)			
	U1	Is able to select appropriate cooling or freezing methods for different food categories.	test	SAFE_U01 SAFE_U02

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	U2	Is able to perform and analyze experiments involving liquid nitrogen and assess changes in product quality.	test	SAFE_U03
	SOCIAL COMPETENCES (graduate is ready to)			
	K1	Is aware of the environmental and safety implications of refrigeration technologies.	test	SAFE_K01
	K2	Can work effectively in a team while following safety procedures related to the use of cryogenic materials.	observation during class	SAFE_K02
Module crediting method	Pass with a grade			
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 for credit (hours 1. ECTS points 0,04)	
	Total contact hours 3 hr. 0,12 pt. ECTS		**Total non-contact hours 2 hr. 0,08 pt. ECTS**	

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Staffing	Dariusz Góral, Katarzyna Kozłowicz
Information on the infrastructure ensuring the implementation of learning outcomes	Classes within the *"Refrigeration Processes in the Processing and Preservation of Agricultural and Food Products"* module are conducted in a building fully accessible to persons with disabilities, ensuring equal access to education for all participants. The **lecture room** is equipped with a modern multimedia projector, sound system, and camera, enabling the use of visual presentations, instructional videos, and hybrid teaching formats. This equipment supports the achievement of **knowledge outcomes (SAFE_W01–SAFE_W04)** by facilitating the effective delivery of theoretical content and demonstration of advanced food processing technologies.The **laboratory room** is equipped with devices and installations that ensure the safe performance of exercises using liquid nitrogen, including proper ventilation systems, protective clothing, and cryogenic containers. Such infrastructure allows students to acquire **practical skills (SAFE_U01–SAFE_U03)** related to the selection and application of refrigeration technologies and the analysis of cryogenic processing effects. These exercises also develop **social competences (SAFE_K01–SAFE_K02)** by promoting teamwork and responsible, safety-oriented conduct during laboratory work.The available infrastructure is fully adequate for achieving the intended learning outcomes, ensuring comfort, safety, and high educational quality in the field of modern refrigeration technologies for the agri-food sector.
Planned teaching methods	lecture, exercises, laboratory
Recommended reading list	*Fellows, P. J. (2022). Food Processing Technology: Principles and Practice (5th ed.). Woodhead Publishing.* *Sun, D. W. (Ed.). (2016). Handbook of Frozen Food Processing and Packaging (2nd ed.). CRC Press* *Sun, D. W. (Ed.). (2011). Handbook of Food Safety Engineering. Wiley-Blackwell.*

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