Order number: 7

Attachment No. 3		**Subject program of the second cycle of studies**			
1.	Title of the teaching subject	Physico-chemical changes during food processing			
2.	Code	FE1M14			
3.	Study program	Food Engineering-Innovation, Sustainability and Technologies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Faculty of Technology and Metallurgy Institute of Organic Technology Department of Food Technology and Biotechnology			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	Year	I	semester	I
7	Course load expressed in ECTS credits	6 ECTS			
8.	Teacher (in the case of multiple teachers designated responsible teacher)	Dr. Elena Velichkova Nikova			
9.	Language of instruction	English			
10.	Necessary prerequisites for listening and passing the subject	Knowledge of biochemistry, food chemistry, rheology, structure and morphology of food			
11.	Objectives of the subject program (competencies) and learning outcomes:	**Objectives of the program:** Acquaintance of students with the chemical and physico-chemical changes in food during its processing. **Learning outcomes:** The student should acquire knowledge about the separate important chemical, biochemical, physical and morphological characteristics of food and be able to independently assess and analyze changes in food products during processing in the food sector.			
12.	Detailed course content by chapter and unit with learning outcomes for each chapter	Reaction mechanisms of lipids, carbohydrates, proteins and minor components in food (endogenous and exogenous). Interaction between food components during processing and storage. The effect of thermal treatments (pasteurization, sterilization, boiling, distillation, dehydration, dielectric and ohmic heating) on nutritional value and sensory properties (texture, taste, aroma, color). Physico-chemical changes in food during low temperature processing (freezing, thawing, freeze drying). Impact of ionizing radiation on nutritional and sensory properties of irradiated food. Changes in food when applying new processing techniques (electric field, application of high pressure, ultrasound and microwaves). Changes in food during baking, frying. Physico-chemical changes in food processing by extrusion. Changes in nutritional and sensory properties during food production by fermentation. Prediction of the shelf life of food in function of overall changes.			
13	Interrelationship of subjects	This subject is related to other subjects from the area			
14.	Detailed description of teaching and working methods for the subject	Interactive theoretical and practical teaching combined with independent work and individual consultations will be applied in all teaching chapters of the course to a varying extent, depending on the number of students. Individual			

		and possibly group or team collaborative and cooperative methods of active learning will be used from the teaching methods. Developing skills for displaying and presenting research according to the latest relevant scientific research in the field of food chemistry and physics.			
15.	Total available fund on time	180			
16.	Forms of teaching activities	16.1.	Lectures - theoretical teaching. hours		30
		16.2.	Exercises (laboratory, classroom), seminars, teamwork: lessons		20
		16.3.	Practice: classes		10
17.	Other forms of activities	17.1.	Project assignments: lessons		20
		17.2.	Independent assignments: lessons		20
		17.3.	Home study - assignments		80
18.	Conditions of signature	Realized 60% of activities under number 16 and 17			
19.	Method of assessment				
	19.1.	Tests: points		25 points	
	19.2.	Seminar work/project, written and oral presentation: points		15 points	
	19.3.	Final exam: points		60 points	
20.	Evaluation criteria (points/grade)		up to 50 points	5 (five) (F)	
			51 x to 60 points	6 (six) (E)	
			61 x to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	A method of monitoring the quality of teaching	Based on Article 10 para. 5 of the Guidelines for self-evaluation and assessment of the quality of UKIM in Skopje, anonymous surveys of students are conducted on the quality of the teacher and associate staff and an anonymous survey on the general conditions for studying			

22.	Literature					
	22.1.	Required reading				
		Ord. number	Author	Title	Publisher	Year
		1.	OP Chauhan	Advances in Food Chemistry Food Components, Processing and Preservation	Springer Singapore, https://doi.org/10.1007/978-981-19-4796-4	2022
		2.	Ludger O. Figure, Arthur A. Teixeira	Food Physics Physical Properties - Measurement and Applications	Springer Cham, https://doi.org/10.1007/978-3-031-27398-8	2023

		3.	DJ McClements	Understanding the Microstructure of Complex Foods	CRC Press, Boca Raton	2008.
		4.	S. Devahastin	Physicochemical aspects of food engineering and processing	CRC Press, Boca Raton	2011
	22.2.	Additional literature				
		Ord. number	Author	Title	Publisher	Year
		1.	Elena Velichkova Nikova	Food Process Engineering Practicum	Faculty of Technology and Metallurgy	2023
		2.	Scientific papers from renowned journals from the last five years in the field of food-structure and properties, for each topic of the program			