Co-funded by the European Union

OFINU

Open Food Innovation University (OFINU)

DESCRIPTION OF STUDY MODULE
“CEREAL TECHNOLOGY”

2024

Summary

The study course is elaborated within the project “Open Food Innovation University" (OFINU), being in implementation with support of the European Union Erasmus+ Programme.

Overall objective of the project - to modernise food innovation and technology related higher education in Uzbekistan and Tajikistan, thereby increasing the quality and ensuring relevance of the higher education to the needs of the socio-economic growth of the countries concerned and especially of their regions.

Full partners:
- Lead partner: Latvia University of Life Sciences and Technologies
- Uzbekistan: Samarkand Agro-innovations and Research University, Andijan Institute of Agriculture and Agro-technologies
- Tajikistan: Technological University of Tajikistan, Kulob Institute of Technology and Innovation Management, Isfara Branch of the Technological University of Tajikistan
- Slovakia: Slovak University of Agriculture in Nitra

Associated partners in Uzbekistan:
- A group of companies "AGROMIR"
- "Navigul" MCHJ QK
- “Samarqand don mahsulotlari” JC (Samarkand grain products)

Associated partners in Tajikistan:
- CJSC “Combinati Shiri Dushanbe”
- LTD "Orion Rustam"
- Association of Entrepreneurs of Khatlon

The project implementation period: 01/02/2024 - 31/01/2027.

Funded by the European Union. Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

Partner universities and their academic staff, involved in the development of the study course:

P1 LBTU. Latvia University of Life Sciences and Technologies

Dace Klava - cereal processing technology.

Tatjana Ķince - cereal processing equipment.

Evita Straumite - sensory evaluation of cereal products.

Sandra Muizniece-Brasava - packaging of cereal products.

Egita Sproge - HACCAP.

P2 SAMARU. Samarkand Agroinnovations and Research University

RahmatilloTashmanov - cereal processing technology.

Temurbek Mikhliev - cereal processing technology.

Yigitali Tashpulatov - cereal processing equipment.

Babur Eshonkulov - cereal processing technology.

Kamoliddin Bozorov - quality management of cereal products.

P3 AIAA. Andijan Institute of Agriculture and Agro-technologies

Murodjon Atajanov - cereal processing technology.

Muhammad Zahiriddin Zaynobiddinov - cereal processing equipment.

Oybek Egamberdiev - quality management of cereal products.

P4 TUT. Technological University of Tajikistan

Mavzuna SHARIPOVA - cereal processing technology.

P5 KITIM. Kulob Institute of Technology and Innovation Management

Iskandar HAKIMOV - cereal processing technology.

P6 BTUTI. Branch of the Technological University of Tajikistan in the city of Isfara

Zokirkhoja Soliev - cereal processing technology.

P7 SUA. Slovak University of Agriculture in Nitra

Eva Ivanišová - cereal processing technology.

INTRODUCTION

Study module **"Cereal Technology "** has been developed for the open university sessions. Every audience from the university, both students and lecturers, from the middle and higher-level specialists of the food industry, as well as anyone interested who wants to learn about cereal processing, bread making and flour confectionery can participate. The study module is designed based on the basic principles of student-centred training using the latest training methods. The module includes the following topics: technological process and equipment, packaging material and equipment, raw materials and product quality evaluation, including sensory evaluation. Quality management assurances in the grain processing. The training of the module is organised in 50% theoretical lessons and 50% practical lessons. During the practical lessons, professional problem situations are solved. Students with different knowledge, professional experience, but with a high degree of interest ensure mutual communication and the learning process by learning from each other.

Aim and objectives of the study subject

The study course aims to deepen the knowledge about the chemical composition, properties, and quality of grain, to learn the basics of grain processing technology and the introduction of innovations, and to understand the physical, biochemical, and microbiological processes during production. To gain knowledge of flour, groats, pasta, and bread quality assessment methods and safety. To get acquainted with the special equipment used in food production, their structure, and operating principles. In the laboratory work, students acquire practical skills in quality control of grain, flour, and other raw materials and the development of bread and special products.

Learning outcomes:

- ***Knowledge*** - knowledgeable about the raw materials of grain processing and bread production, the basic principles of product technology process, and special knowledge of processes, quality assurance, and control. Able to explain the most important terms about grain processing products, their properties, and quality management.
- ***Skills*** to perform quality assessment of raw materials and products, necessary calculations, perform research work, and describe the quality monitoring of grain processing products.
- ***Competence*** to independently obtain, select, and analyse information on the impact of individual raw materials on product quality, and take part in the development and evaluation of new products.

Study Plan for module "Cereal Technology" in Uzbekistan

	Themes	Number of hours			
		Total	Lectures	Practical / Laboratory works	Independent work of the student
1.	Cereals, their characteristics and quality	50	10	12	28
2.	Grain processing - flour, groats, flakes	46	6	12/	28
3.	Pasta production and quality evaluation	42	2	12	28
4.	The basics of bread making	42	6	8	28
5.	Wheat bread technology	48	6	14	28
6.	Wholegrain and traditional bread technology	50	10	12	28
7.	Flour confectionery and traditional confectionary	46	10	8	28
	TOTAL	**324**	50	78	196

Study Plan for module "Cereal Technology" in Tajikistan

	Themes	Number of hours			
		Total	Lectures	Practical / Laboratory works	Independent work of the student
1.	Cereals, their characteristics and quality	50	16	12	23
2.	Grain processing - flour, groats, flakes	46	10	12	23
3.	Pasta production and quality evaluation	43	3	12	23
4.	The basics of bread making	43	10	9	23
5.	Wheat bread technology	48	10	15	23
6.	Wholegrain and traditional bread technology	50	16	12	24
7.	Flour confectionery and traditional confectionary	46	16	9	23
	TOTAL	**324**	81	81	162

Thematic Study Plan for module "Cereal Technology"

Date, Time	Study form	Theme	Lecturer
Theme 1 - Cereals, their characteristics, and quality			
1st day	Lecture (1h)	Introduction lecture about the study course.	
	Lecture (3h)	Grains and their characteristics.	
		Types of grains, chemical composition - carbohydrates, proteins, lipids, their properties, vitamins, minerals, pigments, water. Physical properties of grains. Developmental processes in grains.	
	Laboratory work (4h)	Analysis of grain mechanical and physical properties (thousand grain weight, bulk density, first class proportion, moisture content, hardness, trial milling).	
2nd day	Lecture (2h)	Equipment for receiving and pre-treatment grain.	
	Laboratory work (4h)	Determination of grain quality parameters (Organoleptic, TTA, pH, ash content, moisture).	
	Practical work (2h)	Equipment for receiving and pre-treatment grain.	
3rd day	Lecture (3h)	Quality management in the grain processing industry.	
	Practical work (2h)	Quality management in the grain processing industry.	
4th day	Excursion	Visit to grain processing factory or grain production farm.	
Theme 2 - Grain processing: flour, groats, flakes			
5th day	Seminar (1h)	Grains and quality.	
	Lecture (2h)	Flour production. Production of semolina, couscous, semolina and flakes.	
	Lecture (1h)	Equipment and lines for the production of flour, semolina, and flakes.	
6th day	Laboratory work (3h)	Flour and breakfast flake quality assessment.	
	Practical work (2h)	Packaging of flour and flakes and evaluation of the quality of flakes and muesli.	
7th day	Laboratory work (3h)	Flour quality analysis (determination of ash, protein, Zeleny index, acidity, falling number, quantity and quality of gluten, rheological properties).	

	Lecture (2h)	Sensory evaluation of flour and flakes.	
	Laboratory work (2h)	Sensory evaluation of breakfast cereals, granola and muesli.	
Theme 3 - Pasta production and quality evaluation			
8th day	Seminar (1h)	Flour production and quality.	
	Lecture (2h)	Characteristics of pasta. Technological process of pasta production.	
	Lecture (1h)	Pasta production equipment.	
9th day	Laboratory work (4h)	Pasta production in laboratory condition. Evaluation of pasta quality (cooking ability, water absorption, volume).	
	Practical work (2h)	Packaging of pasta.	
10th day	Laboratory work (4h)	Sensory evaluation of pasta.	
11th day	Excursion	Visit to pasta processing factory or mill.	
Theme 4 - The basics of bread making			
12th day	Seminar (1h)	Pasta in the world.	
	Lecture (3h)	Characteristics of bread industry and tendencies. Characteristics and quality requirements of raw materials used in bread baking. Sourdough role in bread preparation.	
	Lecture (2h)	Equipment for wheat bread making.	
	Lecture (2h)	Sensory evaluation of bread.	
13th day	Laboratory work (2h)	Quality evaluation of raw materials.	
	Laboratory work (1h)	Microbiology analyses of raw materials.	
	Laboratory l work (2h)	Sourdough preparation (1st stage) of sourdough and quality evaluation.	
	Laboratory work (1h)	Microbiology analyses of sourdough (1st stage).	
14th day	Laboratory work (2h)	Sourdough preparation (2nd stage) of sourdough and quality evaluation. Microbiology analyses of sourdough (2nd stage).	
	Laboratory work (2h)	Sourdough preparation (3rd stage) of sourdough and quality evaluation. Microbiology analyses of sourdough (3rd stage).	

Theme 5 - Wheat bread technology			
15th day	Lecture (2h)	Wheat dough processing (dividing, rounding, pre-fermentation, shaping, baking).	
	Lecture (2h)	Equipment for wheat bread making.	
	Laboratory work (2h)	Microbiology analyses of raw materials – results. Microbiology analyses of sourdough 1st stage, microbiota identification of sourdough.	
	Laboratory work (2h)	Baking test of wheat bread with sourdough (kneading dough and fermentation time not less than 8 h).	
16th day	Laboratory work (2h)	Baking test of wheat bread with sourdough.	
	Lecture (2h)	Freeze technologies in wheat bread making.	
	Laboratory work (2h)	Microbiology analyses of sourdough 2nd and 3rd stage, microbiota identification of sourdough 1st stage results.	
17th day	Laboratory work (5h)	Wheat bread with yeast - baking test and freezing processes.	
	Laboratory work (1h)	Microbiota identification of sourdough 1st stage results.	
	Practical work (2h)	Wheat bread packaging.	
18th day	Lecture (2h)	Sensory evaluation of different types of bread.	
	Laboratory work (2h)	Sensory evaluation of different types of bread.	
	Laboratory work (2h)	Evaluation of wheat bread quality.	
	Laboratory work (2h)	Evaluation of wheat bread microbiology quality.	
19th day	Excursion	Visit to bread bakery.	
Theme 6 - Wholegrain and traditional bread technology			
20th day	Seminar (1h)	Nutrition aspects of wheat bread.	
	Lecture (3h)	Ways of preparing rye (wholegrain) dough. Dividing, shaping, and fermentation of rye (wholegrain) dough. Baking rye (wholegrain) bread.	
	Lecture (3h)	Quality management in a bread bakery.	
21th day	Laboratory work (8h)	Baking test of wholegrain bread with sourdough.	
22th day	Practical work (2h)	Packaging and pasteurisation of rye (wholegrain) bread.	
	Laboratory work (2h)	Sensory evaluation of bread.	

	Seminar (2h)	Presentation of analysis of bread faults and their reasons.	
	Laboratory work (2h)	Evaluation of rye bread microbiology quality.	
	Practical work (2h)	Quality management in the bread bakery.	
Theme 7 - Flour confectionery and traditional confectionary			
23th day	Seminar (1h)	Bread around the world.	
	Lecture (4h)	Characteristics of raw materials used in flour confectionery. Types and differences of dough. Fillings and their variety in confectionery.	
	Laboratory work (4h)	Creating new ideas for traditional desserts/cakes - new versions. Preparation of innovative desserts/cakes.	

Themes and their summary in the study module "Cereal technology"

Theme 1. Cereals, their characteristics and quality

Issues to covered in the lectures

1. Grains, their characteristics.
2. Types of grains, chemical composition - carbohydrates, proteins, lipids, their properties, vitamins, minerals, pigments, water.
3. Physical properties of grains. Developmental processes in grains.
4. Equipment for receiving and pre-treatment grain.
5. Quality management in the grain processing industry.
6. Technological equipment for grain pre-treatment (grain driers, removal of impurities, grain surface treatment, grain conditioning, grain cleaning: separators, de-stoners, decontamination plant, grain washing machine; grain storage: warehouses, elevators, grain silo).

Issues to covered in the practical or laboratory works

1. Analysis of grain mechanical and physical properties (thousand grain weight, bulk density, first class proportion, moisture content, hardness).
2. Determination of grain quality parameters (Organoleptic, TTA, pH, Ash content, Falling number; Gluten for wheat).
3. Quality management in the grain processing industry.
4. Opportunities for the development of cereal processing. Preparation of a batch of grain intended for grinding (calculation).

Topics of independent work

1. Which cereals and why will you use gluten-free product development?
2. Which cereals are grown, processed and exported the most in World, EU, Latvia Central Asia?
3. Are quinoa and amaranth grown in Central Asia and EU, what is valuable in these pseudo-cereals?
4. What are the quality requirements of wheat grain in Uzbekistan, Tajikistan and Latvia?
5. How is the volumetric weight of grains and the absolute (1000) grain weight determined and what is characterized?
6. What are the quality requirements of rye grain in Uzbekistan, Tajikistan and Latvia?
7. How is the amount of gluten and the quality of gluten determined and what is characterized?
8. How is the falling number determined and what is it characterized by?

Literature and databases on the theme

1. Rosentrater, K. A., Evers A.D. (2018). Kent's Technology of Cereals: An Introduction for Students of Food Science and Agriculture. A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition (5th ed.). Elsevier Ltd.
2. International Association for Cereal Science and Technology. (2024, July). https://icc.or.at/publications/icc-standards

3. Solgajová M. (2014) Technology of foodstuffs of plant origin. Slovak University of Agriculture in Nitra.

Theme 2. Grain processing - flour, groats, flakes

Issues to covered in the lectures

1. Flour production.
2. Production of semolina, couscous, semolina and flakes.
3. Equipment and lines for the production of flour, semolina and flakes
4. Sensory evaluation of flour, flakes; granola: Sensory parameters of flour - appearance, colour and taste. Possible defects. Sensory evaluation of flakes - dry flakes and with water, structure, colour, taste and aftertaste
5. Technological equipment for flour, groats and flakes production: overview of grain mill constructions, types of mills (rolling, hummer, rotor, disc, pneumatic), groats production equipment, oats flakes production line from groats, aspiration column, grooving plant, steamers, grain flakers construction.

Issues to covered in the practical or laboratory works

1. Preparation of flour, flakes, muesli
2. Packaging of flour and flakes and evaluation of the quality of flakes and muesli
3. Flour quality analysis (determination of ash, Zeleny index, acidity, quantity and quality of gluten, rheological properties).
4. Sensory evaluation of breakfast cereals, granola and muesli.
5. Flour obtaining. Evaluation of fiscal properties of obtained flour and commercial breakfast flakes.

Topics of independent work

1. What cereals are used in the production of flour?
2. Classification of flour according to the amount of grain sheaths.
3. What are the by-products of flour production?
4. What kind of products is barley used in?
5. What products are oats used in production?
6. What is the market demand for breakfast cereals in the EU and Central Asia?
7. Protein extraction from legumes.
8. Resistant starch, its types and production.
9. Types of extrusion and characteristics of the obtained products
10. Types of flour used in the production of extruded products.

Literature and data bases on the theme

1. International Association for Cereal Science and Technology. (2024, June). https://icc.or.at/publications/icc-standards
2. Rosentrater, K. A., Evers A.D. (2018). Kent's Technology of Cereals: An Introduction for Students of Food Science and Agriculture. A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition (5th ed.). Elsevier Ltd.
3. Solgajová M. (2014) Technology of foodstuffs of plant origin. Slovak University of Agriculture in Nitra.

Theme 3. Pasta production and quality evaluation

Issues to covered in the lectures

1. Characteristics of pasta.
2. Technological process of pasta production.
3. Pasta production equipment.
4. Sensory evaluation of pasta: appearance, colour, structure, aroma, taste and aftertaste.
5. Technological equipment for extruded product obtaining: types of extrusion, extruders constructions, screw variations, matrix variations, dry components mixers, pasta drying equipment.

Issues to covered in the practical or laboratory work

1. Pasta production.
2. Packaging of pasta.
3. Sensory evaluation of pasta.
4. Pasta obtaining and quality evaluation.

Topics of independent work

1. What types of flour can be used in the production of gluten-free pasta?
2. What are the quality requirements for gluten-free pasta?
3. Analysis of demand for gluten-free pasta in EU and Central Asian countries.
4. Latest trends in pasta production.

Literature and databases on the theme

1. International Association for Cereal Science and Technology. (2024, June). https://icc.or.at/publications/icc-standards
2. Rosentrater, K. A., Evers A.D. (2018). Kent's Technology of Cereals: An Introduction for Students of Food Science and Agriculture. A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition (5th ed.). Elsevier Ltd.
3. Solgajová M. (2014) Technology of foodstuffs of plant origin. Slovak University of Agriculture in Nitra.
4. Kill R., Turnbull K. (2001) Pasta and Semolina Technology (1st ed.), Wiley-Blackwell.

Theme 4. The basics of bread making

Issues to covered in the lectures

1. Characteristics of the bread industry and tendencies.
2. Characteristics and quality requirements of raw materials used in bread baking.
3. Sourdough role in bread baking.
4. Equipment for wheat bread making.
5. Sensory evaluation of bakery products.

Issues to covered in the practical or laboratory works

1. Quality evaluation of raw materials.
2. Microbiology analyses of raw materials.
3. Sourdough preparation (1st stage) of sourdough and quality evaluation.

4. Microbiology analyses of sourdough (1st stage).
5. Sourdough preparation (2nd stage) of sourdough and quality evaluation.
6. Microbiology analyses of sourdough (2nd stage).
7. Sourdough preparation (3rd stage) of sourdough and quality evaluation.
8. Microbiology analyses of sourdough (3rd stage).
9. Microbiology analyses of raw materials – results.
10. Microbiology analyses of sourdough 1st stage, microbiota identification of sourdough.

Topics of independent work

1. Ways of making bread sourdough.
2. What biotechnological processes occur during sourdough fermentation?
3. The importance of sourdough in the production process of different types of bread.

Literature and data bases on the theme

1. Kulp K. (Ed.). (2000). Handbook of cereal science and technology. New York: Basel: Marcel Dekker.
2. Gobbetti M., Ganzle M. (Ed). (2023). Handbook on Sourdough Biotechnology (2nd ed.). Springer Cham.
3. Ауэрман, Л. Я. (2005). Технология хлебопекарного производства (9-е изд.). Пищевая промышленность.

Theme 5. Wheat bread technology

Issues to covered in the lectures

1. Wheat dough processing (dividing, rounding, pre-fermentation, shaping, baking).
2. Equipment for wheat bread making.
3. Freezing technologies in bread making.
4. Sensory evaluation of different types of bread.

Issues to covered in the practical or laboratory work

1. Test baking of wheat bread with sourdough - kneading dough and fermentation time not less than 8 h and baking.
2. Wheat bread with yeast test baking and freezing process.
3. Wheat bread packaging.
4. Sensory evaluation of different types of bread.
5. Evaluation of wheat bread quality.
6. Evaluation of wheat bread microbiology quality.

Topics of independent work

1. Nutritional characteristics of wheat bread.
2. Describing the technological methods of increasing the nutritional value of wheat bread.
3. Describing the possibilities of increasing the nutritional value of wheat bread by using different plant and animal raw materials.
4. The latest trends in wheat bread production.
5. Raw materials used in the production of gluten-free bread, their differences compared to whole wheat flour.
6. Differences between the gluten-free bread production process and the traditional wheat bread production technology.

Literature and data bases on the theme

1. Cauvain S.P. (Ed.). (2012). Breadmaking: improving quality (2nd ed.). Woodhead.
2. Ауэрман, Л. Я. (2005). Технология хлебопекарного производства (9-е изд.). Пищевая промышленность.

Theme 6. Wholegrain bread and traditional bread technology

Issues to covered in the lectures

1. Ways of preparing rye (wholegrain) dough.
2. Dividing, shaping, and fermentation of rye (wholegrain) dough.
3. Baking wholegrain or rye bread.
4. Traditional bread technologies.
5. Quality management in the bread bakery.

Issues to covered in the practical or laboratory works

1. Test baking of wholegrain bread with sourdough.
2. Packaging and pasteurization of rye (wholegrain) bread.
3. Evaluation of wholegrain bread quality.
4. Evaluation of wholegrain bread microbiology quality.
5. Sensory evaluation of bread (quality evaluation of bread as experts).
6. Presentation of analysis of bread faults and their reasons.

Topics of independent work

1. Characteristics of traditional types of bread in Latvia and Central Asian countries.
2. Nutritional characteristics of whole wheat bread.
3. Differences in technological processes in the production of whole wheat bread.

Literature and data bases on the theme

1. Garcia – Vaquero M., Pastor K., Orhun G. E., McElhatton Rocha F.J.M. (Eds.) (2023). Traditional European breads. Springer Cham.

Theme 7. Flour confectionery and traditional confectionary

Issues to covered in the lectures

1. Characteristics of raw materials used in flour confectionery.
2. Types and differences of dough.
3. Fillings and their variety used in confectionery.

Issues to covered in the practical or laboratory work

1. Creating new ideas for traditional desserts/cakes new version.
2. Prepare innovative desserts/cakes.

Topics of independent work

1. Describing traditional desserts in Latvia, Uzbekistan and Tajikistan.
2. Describing traditional flour confectionery products in Latvia, Uzbekistan and Tajikistan.
3. What are the trends in the production of flour confectionery products?

Literature and databases on the theme

1. Puratos. (2024, June). Food innovations for Good. https://www.puratos.com
2. Wakerhauser C. (2017). Modern French Pastry: Innovative Techniques, Tools and Design. Page Street Publishing.

Literature sources

1. Cauvain S.P. (Ed.). (2012). Breadmaking: improving quality (2nd ed.) Woodhead.
2. Wakerhauser C. (2017). Modern French Pastry: Innovative Techniques, Tools and Design. Page Street Publishing.
3. Aizikovich L.E., Khortsev B.N. (1968). Flour production technology. Kolos.
4. Webster F. (2011). Oats: Chemistry and Technology (2nd ed.). American Association of Cereal Chemists.
5. Kulp K., Ponte J.G. (Eds.). (2000). Handbook of cereal science and technology. Marcel Dekker.
6. Poutanen K., Aman P. (2016). Rye and Health (1st ed.). American Association of Cereal Chemists.
7. Khan K. (2009). Wheat: Chemistry and Technology (4th ed.). American Association of Cereal Chemists.
8. Garcia – Vaquero M., Pastor K., Orhun G. E., McElhatton Rocha F.J.M. (Eds.) (2023) Traditional European breads. Springer Cham.
9. Rosentrater, K. A., Evers A.D. (2018). Kent's Technology of Cereals: An Introduction for Students of Food Science and Agriculture. A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition (5th ed.). Elsevier Ltd.
10. Gobbetti M., Ganzle M. (Ed). (2023). Handbook on Sourdough Biotechnology (2nd ed.). Springer Cham.
11. Shewry P.R.S., Ullrich E. (2016). Barley: Chemistry and Technology. American Association of Cereal Chemists.
12. Kill R., Turnbull K. (2001). Pasta and Semolina Technology (1st ed.). Willey-Blackwell.
13. Solgajová M. (2014) Technology of foodstuffs of plant origin. Slovak University of Agriculture in Nitra.
14. Kuprits Y.N., Demidov G.P. (1977). Technology of grain processing. Kolos.
15. Glukhikh M.A. (2024). Technology of storage and processing of grain and seeds. Publishing House.
16. Ауэрман, Л. Я. (2005). Технология хлебопекарного производства (9-е изд.). Пищевая промышленность.

Materials needed for the implementation of the study course program

Nr.	Material resources and equipment	Quantity / description
1.	Laboratory scales, calculator of seeds, beakers, watch glass	10/for weighting of samples
2.	Hygroscope	10/for quick determination of moisture content
3.	Hectolitre scale	5/for determination of bulk density
4.	Round sieves	5/automatically separation of grains according size (parameters of sieves 2,5 x 20 mm and 2,2 x 20 mm

5.	Calculator of seeds	5/automatically calculation of thousand grains for thousand grain weight determination
6.	Beakers	20/glass volume 200 ml
7.	Watch glass	20/125 mm, laboratory
8.	Pipettes	20/glass volume 10 ml
9.	Pipette attachment	20/for safety pipette of solution
10.	NaOH p.a.	5 of 1kg/p.a.
11.	Viscometer/Visco Analyser	1/for falling number, from Perten company
12.	Tube for Viscometer/Visco Analyser	30/glass compatible with Viscometer/Visco Analyser
13.	Brabender mill	1/Brabender: Quadrumat Junior for trial milling
14.	Thermostat	2/classical thermostat for incubation of samples
15.	Equipment for sedimentation/Zeleny index	2/Sedimentation Shaker - Flour Mixing Test
16.	Special Zeleny cylinder with stopper	20/glass with accordance to Sedimentation Shaker - Flour Mixing Test
17.	Volumetric flask	20/glass, volume 100 ml
18.	Farinograph	1/BRABENDER Farinograph
19.	Extensograph	1/BRABENDER Extensograph
20.	Amylograph	1/BRABENDER Amylograph
21.	Muffle oven	1/Laboratory muffle over (furnace) max. 1000℃
22.	Porcelain crucible for ash determination	50/Porcelain Crucibles are used with Muffle Furnaces for loss-on-ignition (LOI) testing of cement, fly ash, and soil materials. They are temperature-rated to (1 000 °C). They have a high-form design and are glazed inside and out, except for the outside bottom and rim. The crucibles are available in three sizes and are sold in packages of five, volume 50 ml.

23.	Automatic Kjeldahl analyzer	1/automatic device integrating distillation and titration functions and it is designed based on classic Kjeldahl nitrogen determination method.
24.	Special tubes for Automatic Kjeldahl analyzer	30/digestion tube 250 ml straight
25.	Fresh pasta maker	2/heavy duty construction, water cooler, produces pasta of different shapes, production: 25 kg per hour, with dough cutter, safety switch on the tank and lid, stainless steel tank and stirrer.
26.	Cylinder	5/glass 1000 ml
27.	Plates	30/classical kitchen white plate
28.	Pots	20/pot stainless steel, 6,6 L
29.	Sieve	10/ Kitchen metal sieve, medium 18cm, stainless steel, silver
30.	Cooker	10/Induction electric cooker, 1200 W, body stainless steel
31.	Extruder	For pasta obtaining
32.	Texture analyser	For determination of pasta and flakes textural properties
33.	Water activity analyser	For determination of water activity of cereals products
34.	Schive	For flour separation for 160 microns, 250 microns, 315 microns and 450 microns.
35.	Incubator	For sourdough development and microorganism evaluation
36.	Dough mixer	For bread preparation
37.	Dough proofer	Bread baking
38.	Bread baking rotation Oven	Bread baking
39.	Shock freezer	Bread freezing
40.	Freezer	Bread freezing
41.	Packaging equipment.	Flour, pasta, bread packaging

Methods used for the implementation of the study course program

Nr.	Types	Methods possible to be applied
1.	Interactive teaching tools	Use of interactive technologies and educational programs to educate students, such as computer simulations, virtual laboratories, and online courses.
2.	Lectures	Presentation of theoretical material by the teacher. Lectures may include basic concepts, principles and technologies of the studied theme
3.	Laboratory works	Working with equipment and tools, conducting experiments, tasting and analysing fruit and vegetable samples and their product samples. Practical classes help students consolidate theoretical knowledge in practice.
4.	Seminars	Compilation and explanation of the data obtained in laboratory work with theoretically learned material, clarifying the differences. Analysis of problem situations from the point of view of the fruit and vegetable processing industry