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OFINU

Open Food Innovation University (OFINU)

DESCRIPTION OF STUDY MODULE

“MEAT PROCESSING TECHNOLOGIES”

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

Ilze Gramatina - meat processing technologies, ilze.gramatina@lbtu.lv
Sandra Muizniece-Brasava - packaging of meat and meat products, sandra.muizniece@lbtu.lv
Normunds Puzulis - meat processing equipment, normunds.puzulis@inbox.lv
Evita Straumite - sensory evaluation of meat and meat products, evita.starumite@lbtu.lv
Egija Sproge - HACCAP, egita.sproge.egita@gmail.com

P2 SAMARU. Samarkand Agroinnovations and Research University

Elnara Devletshaeva - technology of storage and processing of livestock products, elnaradevletshayeva@gmail.com
RahmatilloTashmanov - technology of storage and processing of agricultural products, tashmanovraxmatillo@gmail.com

P3 AIAA. Andijan Institute of Agriculture and Agro-technologies

Rakhim Mirzaev - technology of storage and processing of agricultural products, r.mirzayev0406@gmail.com
Kholdarov Shukhratjon - technology of storage and processing of agricultural products, shuhratxoldarov7777@gmail.com

P5 KITIM. Kulob Institute of Technology and Innovation Management

Amrudin Rustamov - technology of meat and meat products, rustamovamridin423@gmail.com
Safar Odinaev - technology of meat and meat products, odinaevsafar35@gmail.com

P7 SUA. Slovak University of Agriculture in Nitra

Miroslava Kačániová - microbiologist, miroslava.kacaniova@gmail.com

INTRODUCTION

Study modules "Meat processing technologies" have been developed for the students can obtain the knowledge about criteria for estimation chemical composition, physical properties of meat quality. Students also receive a basic knowledge about physical, biochemical and microbiological processes in meat production, necessary equipment and packaging. They gain knowledge about the reasons for defects in various meat products, food safety requirements for the production of meat products.

Aim and objectives of the study subject is to provide knowledge about the technological processes of meat productions, product packaging possibilities, quality requirements and assurance. The students can obtain the knowledge and understanding about technological processes of meat and meat products production and equipment, various packaging materials, meat quality and safety issues, when preparation for seminars, practical and laboratory works.

Learning outcomes

- ***Knowledge*** – is able to understand the key concepts and regularities of the industry, to decide on more suitable production processes, equipment and to find solutions for new product development;
- ***Skills*** – perform innovative and research activities in formulating and analysing the problems of meat processing industry, is able to explain and do reasonable discussion of the meat processing problems.
- ***Competence*** – is able to independently obtain, select and analyse information, make decisions and solve problems in the quality assurance of production of meat products and in the development of innovations.

Study Plan for module "Meat Processing Technologies"

Themes	**Number of hours** LV/ UZB/ TJ			
	Total	Lectures	Practical works	Independent work of the student
Theme 1. Meat and its general characteristics, and quality	43/ 34/ 40	5/ 4/ 4	8/ 0/ 0	30/ 30/ 36
Theme 2. Biochemical and microbiological processes in meat	50/ 54/ 50	8/ 8/ 6	8/ 12/ 8	34/ 34/ 36
Theme 3. The slaughter process of animals and birds	47/ 50/ 50	4/ 6/ 4	9/ 10/ 8	34/ 34/ 38
Theme 4. Meat preservation methods	64/ 70/ 60	18/ 20/ 10	12/ 16/ 10	34/ 34/ 40
Theme 5. Meat products	77/ 76/ 76	18/ 16/ 14	25/ 26/ 22	34/ 34/ 40
Theme 6. Canned meat products	43/ 40/ 48	5/ 4/ 6	8/ 6/ 6	30/ 30/ 36
TOTAL	**324**	58/ 58/ 44	70/ 70/ 54	196/ 196/ 226

Thematic Study Plan for module "Meat Processing Technologies"

Date, Time	Study form	Theme	Lecturer
Theme 1. Meat and its general characteristics, and quality			
1st day	Lecture (1h)	Introductory lecture in the study course.	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (3h)	Morphological structure of meat (*Technology)*.	Dr.sc.ing., assist. prof., I. Gramatina
		Meat quality, chemical composition and nutritional value (*Technology)*.	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (1h)	The most suitable packaging materials for fresh meat (*Packaging*).	Dr.sc.ing., prof., S. Muizniece-Brasava
	Lecture (1h)	Meat safety and risk assessment (*Quality*).	Mg.paed., lecturer, E. Sproge
2nd day	Laboratory work (8h)	1st Laboratory work – evaluation of the chemical composition of meat using physico-chemical quality analysis methods (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
Theme 2. Biochemical and microbiological processes in meat			
3rd day	Lecture (2h)	Biochemistry and microbiological developments in meat. Meat rigor-mortis, maturation and breaking down (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
	Lectures (2h)	Characteristics of main technological equipment (*Equipment*).	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (3h)	Intensification of the maturation process. Meat maturation, PSE and DFD defective meat (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (1h)	Contamination, safety and risk assessment (*Microbiology*).	PhD. prof., M. Kačániová
4th day	Laboratory work (8h)	2nd Laboratory work – assessment of meat freshness using sensory, physic-chemical and microbiological quality analysis methods (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
Theme 3. The slaughter process of animals and birds			
5th day	Laboratory work (1h)	Microbiological testing of chilled meat (*Microbiology*).	PhD. prof., M. Kačániová
	Lecture (3h)	Preparation of animals, birds for processing, and slaughtering. Animals and birds carcass division (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (1h)	By-products, use and processing (*Technology*).	Dr.sc.ing., assist. prof.,

			I. Gramatina
		Intestinal structure and treatment (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
6th day	Laboratory work (8h)	3rd Laboratory work – evaluating the quality of food fat by analysing changes in the sensory and physical-chemical quality indices (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
Theme 4. Meat preservation methods			
7th day	Lecture (2h)	Meat preservation methods. Chilling and storage of meat (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (1h)	Quality indicators of meat (*Sensory evaluation*).	Dr.sc.ing., prof., E. Straumite
	Seminar (2h)	Sensory evaluation of meat (*Sensory evaluation*).	Dr.sc.ing., prof., E. Straumite
	Lecture (1h)	Chilled and frozen meat safety and risk assessment (*Quality*).	Mg.paed., lecturer, E. Sproge
8th day	Lecture (2h)	Meat freezing, changes in quality indicators during storage (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (2h)	Characteristics of equipment (*Equipment)*.	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (1h)	Package selection for preserved meat (*Packaging*).	Dr.sc.ing., prof., S. Muizniece-Brasava
	Practical work (3h)	Safety and risk assessment of meat (*Quality*).	Mg.tqf., lecturer, E. Sproge
9th day	Lecture (2h)	Meat salting types, storage and characterisation of quality indicators (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (1h)	Contamination risks of preserved meat (*Microbiology*).	PhD. prof., M. Kačániová
	Laboratory work (2h)	Microbiological testing of semi-finished meat products (*Microbiology*).	PhD. prof., M. Kačániová
	Practical work (2h)	Mechanical equipment for meat processing (*Equipment*).	Dr.sc.ing., assist. prof., I. Gramatina
10th day	Lecture (2h)	Meat smoking, smoking methods, changes in quality indicators (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina

	Lecture (2h)	Meat product drying methods, quality indicators and their changes (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (1h)	Optimal packaging solutions for preserved meat products (*Packaging*).	Dr.sc.ing., prof., S. Muizniece-Brasava
11th day	Lecture (1h)	Security and risks of salted, smoked and dried products (*Quality*).	Mg.paed., lecturer, E. Sproge
	Seminar (3h)	Optimal packaging solutions for preserved meat products (*Packaging*).	Dr.sc.ing., prof., S. Muizniece-Brasava
Theme 5. Meat products			
12th day	Lecture (2h)	Classification of semi-finished meat products (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (3h)	The main raw materials for meat products production and their characterisation (*Technology).*	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (1h)	Sensory quality indicators of meat products and their changes during storage (*Sensory evaluation*).	Dr.sc.ing., prof., E. Straumite
13th day	Laboratory wok (8h)	4th Laboratory work – preparation of semi-dry and cooked sausages, determination and analysis of sensory, physical-chemical, microbiological quality indicators (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
14th day	Lecture (2h)	Characteristics of the main equipment used in the processing of meat products (*Equipment*).	Dr.sc.ing., assist. prof., I. Gramatina
	Laboratory work (2h)	Microbiological evaluation of processed meat products (*Microbiology*).	PhD. prof., M. Kačániová
	Lecture (4h)	Meat cooking technologies (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
15th day	Seminar (3h)	Sensory evaluation of meat products (*Sensory evaluation*).	Dr.sc.ing., prof., E. Straumite
	Lecture (1h)	Microbiological quality indicators of meat products and their changes during storage (*Microbiology*).	PhD. prof., M. Kačániová
	Lecture (1h)	Meat product safety and risks (*Quality*).	Mg.paed., lecturer, E. Sproge
16th day	Laboratory works (8h)	5th Laboratory work – preparation of semi-finished products and liver pate or liver sausages, determination and analysis of sensory, physical-	Dr.sc.ing., assist. prof., I. Gramatina

		chemical, and microbiological quality indicators (*Technology*).	
17th day	Lecture (3h)	Most important meat products sensory, physical-chemical, microbiological methods of analysis and equipment (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
	Seminar (3h)	Sensory evaluation of meat products (*Sensory evaluation*).	Dr.sc.ing., prof., E. Straumite
	Lecture (1h)	Meat product safety and risk assessment (*Quality*).	Mg.paed., lecturer, E. Sproge
	Laboratory work (1h)	Microbiological evaluation of meat processing products (*Microbiology*).	prof., M. Kačániová
Theme 6. Canned meat products			
18th day	Lecture (3h)	Canned meat technology. Changes during heat treatment, and quality indicators (*Technology*).	Dr.sc.ing., assist. prof., I. Gramatina
	Lecture (1h)	Meat products contamination risks (*Microbiology*).	PhD, prof., M. Kačániová
	Lecture (1h)	Most value packaging types and materials for canned meat products (*Packaging*).	Dr.sc.ing., prof., S. Muizniece-Brasava
19th day	Seminar (3h)	Package as added value of meat products (*Package*).	Dr.sc.ing., prof., S. Muizniece-Brasava
	Practical work (3h)	Meat product safety and risk assessment (*Quality*).	Mg.paed., lecturer, E. Sproge
	Practical work (2h)	Thermal equipment for meat processing (*Equipment*).	Dr.sc.ing., assist. prof., I. Gramatina

Themes and their summary in study module "Meat processing technologies"

Theme 1. Meat and its general characteristics, and quality

Issues to be covered in the lectures

1. Morphological structure of meat - muscle, fat and connective tissue, bone and cartilages.
2. Meat quality, chemical composition (water, proteins, fat, carbohydrates) and nutritional value.
3. The most suitable packaging materials for fresh meat.
4. Meat safety and risk assessment.

Issues to be covered in the practical or laboratory works and seminars

1. Evaluation of the chemical composition of meat using physico-chemical quality analysis methods.

Topics of independent work

1. Study the morphological composition of meat of various animals.
2. Study the chemical composition of meat and nutritional value of various types of slaughtered animals.
3. Packaging materials for meat products.

Literature and databases on the theme

1. Heinz, G., & Hautzinger, P. (2007). Meat processing technology. Bangkok: Food and Agriculture Organization. https://openknowledge.fao.org/server/api/core/bitstreams/4cfabbd3-16aa-47f8-ac6f-b54a48cb8abd/content
2. Toldra, F. (2010). Handbook of meat processing. Wiley-Blackwell https://onlinelibrary.wiley.com/doi/book/10.1002/9780813820897
3. Винникова, Л. Г. (2006). Технология мяса и мясных продуктов. ИНКОС.
4. Рогов, И.А., Жаринов, А.И., Текутъева, Л.А., Шепелъ, Т.А. (2009). Биотехнология мяса и мясопродуктов. ДеЛи принт.
5. Лисицын, А.Б., Липатов, Н.Н., Кудряшов, Л.С., Алексахина, В.А., & Чернуха, И.М. (2008). Технология и практика переработки мяса. Эдиториал сервис.
6. Yaranoglu, B., Zengin, M., Gokce, M., Varol Avcilar, O., Berhun Postaci, B., Erdogan, C., Odabas, E. (2023). Chemical composition of meat from different species of animals. International Journal of Agriculture, Environment and Food Sciences, 7(3), 581-587. https://dergipark.org.tr/en/download/article-file/3287716

Theme 2. Biochemical and microbiological processes in meat

Issues to be covered in the lectures

1. Biochemistry and microbiological developments in meat. Meat rigor-mortis, maturation and breaking down.
2. Characteristics of main technological equipment.
3. Intensification of the maturation process. Meat maturation, PSE and DFD defective meat.
4. Contamination, safety and risk assessment.

Issues to be covered in the practical or laboratory works and seminars

1. Assessment of meat freshness using sensory, physic-chemical and microbiological quality analysis methods.

Topics of independent work

1. Biochemical changes during freezing.
2. Microbiological changes during storage.
3. Methods of freezing meat. Advantages and disadvantages of various methods of freezing meat.

Literature and databases on the theme

1. Heinz, G., & Hautzinger, P. (2007). Meat processing technology. Bangkok: Food and Agriculture Organization. https://openknowledge.fao.org/server/api/core/bitstreams/4cfabbd3-16aa-47f8-ac6f-b54a48cb8abd/content
2. Toldra, F. (2010). Handbook of meat processing. Wiley-Blackwell. https://onlinelibrary.wiley.com/doi/book/10.1002/9780813820897
3. Винникова, Л. Г. (2006). Технология мяса и мясных продуктов. ИНКОС.
4. Рогов, И.А., Жаринов, А.И., Текутъева, Л.А., Шепелъ, Т.А. (2009). Биотехнология мяса и мясопродуктов. ДеЛи принт.
5. Лисицын, А.Б., Липатов, Н.Н., Кудряшов, Л.С., Алексахина, В.А., Чернуха, И.М. (2008). Технология и практика переработки мяса. Эдиториал сервис.
6. Алимардонова, М. (2009). Биохимия мяса и мясных продуктов. Фолнат. https://library.tou.edu.kz/fulltext/buuk/a260.pdf
7. Normahmatov. R. (2013). Oliy o'quv yurtlari talabalari uchun darslik. Tafakkur.

Theme 3. The slaughter process of animals and birds

Issues to be covered in the lectures

1. Preparation of animals, birds for processing, and slaughtering. Animals and birds carcass division.
2. By-products, use and processing. Intestinal structure and treatment.

Issues to be covered in the practical or laboratory works and seminars

1. Microbiological testing of chilled meat.
2. Evaluating the quality of food fat by analysing changes in the sensory and physico-chemical quality indices.

Topics of independent work

1. Main changes and technological aspects of slaughtering livestock and poultry on an industrial scale.
2. Modern technology for slaughtering cattle.
3. Poultry slaughter technology.

Literature and databases on the theme

8. Heinz, G., & Hautzinger, P. (2007). Meat processing technology. Bangkok: Food and Agriculture Organization.

https://openknowledge.fao.org/server/api/core/bitstreams/4cfabbd3-16aa-47f8-ac6f-b54a48cb8abd/content
9. Toldra, F. (2010). Handbook of meat processing. Wiley-Blackwell. https://onlinelibrary.wiley.com/doi/book/10.1002/9780813820897
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11. Рогов, И.А., Жаринов, А.И., Текутъева, Л.А., Шепелъ, Т.А. (2009). Биотехнология мяса и мясопродуктов. ДеЛи принт.
12. Лисицын, А.Б., Липатов, Н.Н., Кудряшов, Л.С., Алексахина, В.А., Чернуха, И.М. (2008). Технология и практика переработки мяса. Эдиториал сервис.
13. Алимардонова, М. (2009). Биохимия мяса и мясных продуктов. Фолнат. https://library.tou.edu.kz/fulltext/buuk/a260.pdf
14. Normahmatov. R. (2013). Oliy o'quv yurtlari talabalari uchun darslik. Tafakkur.

Theme 4. Meat preservation methods

Issues to be covered in the lectures

1. Meat preservation methods. Chilling and storage of meat.
2. Quality indicators of meat.
3. Chilled and frozen meat safety and risk assessment.
4. Meat freezing, changes in quality indicators during storage.
5. Characteristics of equipment.
6. Package selection for preserved meat.
7. Meat salting types, storage and characterisation of quality indicators.
8. Contamination risks of preserved meat.
9. Meat smoking, smoking methods, changes in quality indicators.
10. Meat product drying methods, quality indicators and their changes.
11. Optimal packaging solutions for preserved meat products.
12. Security and risks of salted, smoked and dried products.

Issues to be covered in the practical or laboratory works and seminars

1. Sensory evaluation of meat.
2. Safety and risk assessment of meat.
3. Microbiological testing of semi-finished meat products.
4. Mechanical equipment for meat processing.
5. Optimal packaging solutions for preserved meat products.

Topics of independent work

1. Preservation of meat and products by exposing them to chemicals.
2. Preserving meat by salting.
3. Canning at high temperatures.

Literature and databases on the theme

15. Heinz, G., & Hautzinger, P. (2007). Meat processing technology. Bangkok: Food and Agriculture Organization. https://openknowledge.fao.org/server/api/core/bitstreams/4cfabbd3-16aa-47f8-ac6f-b54a48cb8abd/content
16. Toldra, F. (2010). Handbook of meat processing. Wiley-Blackwell. https://onlinelibrary.wiley.com/doi/book/10.1002/9780813820897

17. Винникова, Л. Г. (2006). Технология мяса и мясных продуктов. ИНКОС.
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Theme 5. Meat products

Issues to be covered in the lectures

1. Classification of semi-finished meat products.
2. The main raw materials for meat products production and their characterisation.
3. Sensory quality indicators of meat products and their changes during storage.
4. Characteristics of the main equipment used in the processing of meat products.
5. Meat cooking technologies.
6. Microbiological quality indicators of meat products and their changes during storage.
7. Meat product safety and risks.
8. Most important meat products sensory, physico-chemical, microbiological methods of analysis and equipment.
9. Meat product safety and risk assessment.

Issues to be covered in the practical or laboratory works and seminars

1. Preparation of semi-dry and cooked sausages, determination and analysis of sensory, physico-chemical, microbiological quality indicators.
2. Microbiological evaluation of processed meat products.
3. Sensory evaluation of meat products.
4. Preparation of semi-finished products and liver pate or liver sausages, determination and analysis of sensory, physico-chemical, and microbiological quality indicators.
5. Sensory evaluation of meat products.
6. Microbiological evaluation of meat processing products.

Topics of independent work

1. Meat products classification.
2. Sausages and its classifications.
3. Canned meat and smoked meats products.

Literature and databases on the theme

1. Heinz, G., Hautzinger, P. (2007). Meat processing technology. Food and Agriculture Organization. https://openknowledge.fao.org/server/api/core/bitstreams/4cfabbd3-16aa-47f8-ac6f-b54a48cb8abd/content
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3. Винникова, Л. Г. (2006). Технология мяса и мясных продуктов. ИНКОС.
4. Зонин, В.Г. (2007). Современное производство колбасных и солено-копченых изделий. Профессия.

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8. Алимардонова, М. (2009). Биохимия мяса и мясных продуктов. Фолнат. https://library.tou.edu.kz/fulltext/buuk/a260.pdf
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Theme 6. Canned meat products

Issues to be covered in the lectures

1. Canned meat technology. Changes during heat treatment, and quality indicators.
2. Meat products contamination risks.
3. Most value packaging types and materials for canned meat products.

Issues to be covered in the practical or laboratory works and seminars

1. Package as added value of meat products.
2. Meat product safety and risk assessment.
3. Thermal equipment for meat processing.

Topics of independent work

1. Classification of canned products.
2. Processes occurring during canning of meat.
3. The influence of packaging material on the quality of canned products.

Literature and databases on the theme

1. Heinz, G., Hautzinger, P. (2007). Meat processing technology. Bangkok: Food and Agriculture Organization. https://openknowledge.fao.org/server/api/core/bitstreams/4cfabbd3-16aa-47f8-ac6f-b54a48cb8abd/content
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6. Лисицын, А.Б., Липатов, Н.Н., Кудряшов, Л.С., Алексахина, В.А., Чернуха, И.М. (2008). Технология и практика переработки мяса. Эдиториал сервис.
7. Алимардонова, М. (2009). Биохимия мяса и мясных продуктов. Учебное пособие. Фолнат. https://library.tou.edu.kz/fulltext/buuk/a260.pdf
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Materials needed for the implementation of the study course program

Nr.	Material resources and equipment	Quantity / description
1.	Textbooks on technology of meat and meat products	1. Алимардонова, М. (2009). *Биохимия мяса и мясных продуктов.* Учебное пособие. - Астана: Фолнат. 2. Normahmatov. R. (2013). *Oliy o'quv yurtlari talabalari uchun darslik*. T.: Tafakkur. 515 bet. 3. Бахромов, А.Б. (1996). *Товаршунослик асослари.* Тошкент ТХХИ.
2.	Calibrators and measuring instruments	
3.	Devices for determining pH	For measuring the samples pH
4.	Microscope	For analysing the microorganisms type
5.	Thermostats	For samples incubation
6.	Oven for samples drying from 90-150 ºC temperature	For moisture content determination
7.	Scales with a precision of 0.01 and 0.0001 grams	
8.	Water bath for samples heating at 70 to 75 ºC temperature	For fat content determination
9.	Centrifuge with 800 to 1000 rpm	For fat content determination
10.	Muffle for samples heating at 600 to 800 ºC temperature	For ash content determination

Nr.	Material resources and equipment	Quantity / description
11.	Kjeldahl apparatus (mineralization block and distillation unit)	For protein content determination
12.	Meat grinder with different mesh sizes of grinder	For meat samples preparation
13.	Microorganisms colony counter	For microorganism cony count
14.	Bag mixer	For sample preparation for microbiology
15.	Products packaging equipment	For meat and meat products packaging
16.	Meat sausages stuffing equipment	For sausages making
17.	Blender	For liver pate making

Methods used for the implementation of the study course program

No.	Types	Methods possible to be applied
1.	Lectures	Presentation of theoretical material by the teacher in front of the audience. Lectures may include basic concepts, principles and technologies of meat processing.
2.	Practical work	Working with equipment and tools, conducting experiments, tasting and analysing meat samples. Practical classes help students consolidate theoretical knowledge in practice.
3.	Use of visual and interactive materials	Presentations, video tutorials, interactive websites, and simulations that help visualise and explain key concepts and processes.
4.	Case method	Study real-life cases and examples from the meat processing industry to analyse problems, make decisions and develop strategies.