

Learning Manual Course 1

COURSE	1. MEAT PRODUCTION AND MEAT QUALITY		
Learning Objectives	At the end of this course students will have acquired knowledge on the following issues a) the basis of meat production in the farm, b) carcass quality and grading and primals obtained, c) basis of meat science and meat quality, d) how meat quality can be modulated by ante mortem factors, e) meat storage by low temperatures, meat packaging and meat ageing processes, and f) consumers' perception of meat quality.		
Learning Tools	Powerpoint presentations, multimedia, further reading, lab manuals, assessments		
Duration	48 h (+ 14 h practicals) = 62 h		
Learning Steps			
Training Subjects	Theory Topics	Short Description	Duration (h)
1.1. A general view of meat production systems	1.1.1. Beef production systems	Overview of beef production; Main breeds for beef production; Beef production systems in Europe; Efficiency and profitability of beef production systems; Environmental impact and future of the sector	2
	1.1.2. Small ruminants production systems	Overview of sheep and goat meat production systems; Main breeds for sheep and goat meat production; Sheep and goat meat production systems in Europe; Environmental impact and future of the sector	2
	1.1.3. Pork production systems	Overview of pork production systems; Main breeds for pork production and breeding systems; Pig farming and production systems in Europe; Environmental impact and future of the sector	2
	1.1.4. Poultry production systems	Overview of poultry meat production; Glossary and terms in poultry farming systems; Main breeds and poultry meat farming systems; Environmental impact and future of the sector	2

1.2. Carcass quality and jointing	1.2.1. General principles. Carcass yield and composition, and meat cuts	What is a carcass?; Carcass definition; Body weight and carcass weight; Killing-out percentage; Empty body weight and true dressing percentage; Carcass composition; Meat cuts	2
	1.2.2. Methods for carcass-quality evaluation	Visual assessments of fatness and conformation; Carcass measurements; Sample joint dissection; Electronic measurements	2
	1.2.3. New and emergent methods of predicting body and carcass composition	Ultrasound; X-ray Technologies; Nuclear Magnetic resonance; Video image analysis	2
	1.2.4. Commercial carcass grading and classification	Carcass classification; Carcass grading; Carcass classification in Europe	2
1.3. Basics of meat science and meat quality	1.3.1. Meat science lexicon, muscle structure and composition	Meat science lexicon; meat structure; basic meat composition; muscle growth	2
	1.3.2. Conversion of muscle to meat	Conversion of muscle to meat (CMM); Factors affecting conversion of muscle to meat: acidification, DFD and PSE meats; Factors affecting conversion of muscle to meat: loss of extensibility, cold shortening, thaw rigour; Other quality issues during conversion of muscle to meat	2
	1.3.3. Meat colour and flavour	Meat colour; Meat flavour	2
	1.3.4. Meat texture	Meat juiciness; Meat tenderness	2
1.4. Production factors and meat quality	1.4.1. Effect of animal species, breed, genetic type, gender and age (slaughter weight)	Effect of animal species on meat composition and organoleptic characteristics; Effect of breed and genotype on meat composition and organoleptic characteristics; Effect of age on meat composition and	2

		organoleptic characteristics; Effect of sex on meat composition and organoleptic characteristics; Effect of type of muscle on meat composition and organoleptic characteristics	
	1.4.2. Effect of feeding and nutrition on meat quality	Effect of feed restriction on meat quality; Effect of fibre and energy density on meat quality; Effect of protein (quantity and quality) on meat quality; Effect of lipid source on meat quality; Effect of micronutrients on meat quality; Effect of bioactive components on meat quality; Effect of prenatal nutrition on meat quality (metabolic programming)	2
	1.4.3. Effect of environmental farm conditions and animal welfare on meat quality	Animal housing conditions (allowance space, manger space); Physical exercise; Climatic conditions; Human-animal relationships	2
	1.4.4. Off-farm factors and meat quality	Stress and meat quality; Effects of transportation conditions on meat quality; Effects of lairage conditions on meat quality; Effects of stunning procedure on meat quality; Events leading to PSE and DFD meat	2
1.5. Meat handling and storage procedures	1.5.1. Meat chilling and conventional chilled storage	Meat chilling; Conventional (in-air) chilled storage; Shelf-life of stored meat; Meat microbiology and microbial spoilage under aerobic storage	2
	1.5.2. Meat packaging	Introduction; Vacuum packaging; Modified atmosphere packaging	2
	1.5.3. Meat preservation by freezing	Meat freezing, frozen storage and thawing; Changes in meat due to freezing/storage/thawing; Shelf life of frozen meat	2
	1.5.4. Meat ageing	Concept of meat ageing; Meat quality changes due to meat ageing;	2

		Environmental conditions for meat ageing; Microbiological concerns; Factors affecting meat ageing	
1.6. Consumers' perception of meat quality and meat consumption	1.6.1. Sensory perception and factors influencing the sensory perception of meat	Introduction; Importance of sensory perception in the meat industry; Components of sensory perception; Factors influencing sensory perception; Sensory evaluation methods; Consumer sensory preferences; Challenges in sensory evaluation	2
	1.6.2. Consumer attitudes and beliefs. Perception of specialty meats	Consumer attitudes and beliefs; Specialty meats overview; Organic meat; Grass-fed meat; Other specialty meats; Lessons learned	2
	1.6.3. Consumer decision-making. Communication and marketing. Meat purchase	Consumer decision-making process; Communication and marketing strategies; Meat purchase trends; Integrating specialty meats into marketing; Sensory market in the meat industry	2
	1.6.4. Cross-cultural and regional differences. Globalization and meat consumption patterns	Cross-cultural influence; Globalization's impact on meat; Consumption; Environmental considerations; Future outlook	2
Practical Part	Course 1 Lab Manual: 1.3.1-Meat pH 1.3.2-Meat water holding capacity 1.3.3-Meat myoglobin content 1.3.4-Meat colour 1.3.5-Meat texture 1.5.1-Total aerobic microbial counts 1.5.2-Thiobarbituric acid reactive substances content in meat		14

<p>Multimedia</p>	<ul style="list-style-type: none"> ● Videos produced by InnoMeatEdu <ol style="list-style-type: none"> 1. Production of Black Pig Sausages <ul style="list-style-type: none"> ● Other videos <ol style="list-style-type: none"> 1. Fully automatic ultrasonic pig carcass grading, Frontmatec (1:27) https://youtu.be/qurqjJ_sHwk 2. Fully automatic beef carcass grading , Frontmatec BCC-3 (1:13) https://www.youtube.com/watch?v=ijNVJlCyWYQ 3. Maximising Meat Quality (Farrel, D.; Agri-food & Biosciences Institute) (18:09) https://www.youtube.com/watch?v=CQ-n3y3z7TQ 4. A series of more than 50 videos where expert researchers connect feeding and meat quality from (Feed channel) (from 2:10 to 1:15:00) https://www.feedchannel.online/search/perform?search=meat 5. A series of short (about 3 min) videos from the project mEATquality Linking extensive husbandry practices to the intrinsic quality of pork and broiler meat. Funded by the European Union https://meatquality.eu/video-photos/ ● Web pages <ol style="list-style-type: none"> 1. How much water for 1 kg of meat? (2 min reading approx.) https://meatthefacts.eu/home/activity/campaign-updates/how-much-water-for-1-kg-of-meat/ 2. The glossary of pig farming terminology (2 min reading approx.) 3. https://modernfrontierswoman.com/the-glossary-of-pig-farming-terminology/ 4. Pork Meat Market Analysis in 2024 (4 min reading approx.) https://fhafnb.com/blog/pork-meat-market/ 5. The life of broiler chickens (10 min reading approx.) https://www.ciwf.org.uk/media/5235306/The-life-of-Broiler-chickens.pdf 6. What are the different breeds of chicken? (Chalmes, M.) (10 min reading approx.) https://thehumaneleague.org.uk/article/what-are-the-different-breeds-of-chicken-farming 	
<p>Other Useful Resources</p>		

References and
Further Reading

<https://innomeatedu.unileon.es/mod/page/view.php?id=277>

Learning Manual Course 2

COURSE	MEAT PROCESSING FUNDAMENTALS		
Learning Objectives	At the end of this course, students will have learned materials used in processed meat products (meat, fat, non-meat components, food additives), methods for preserving meat (drying, salting and curing, smoking, fermentation), processing techniques and categories of processed meat products. Students will be able to face issues associated with completing raw materials, devices and parameters used in the production of a wide variety of meat products.		
Learning Tools	Powerpoint presentations, multimedia, further reading, exercises, assessments.		
Duration	34 h (+13 h practical) = 47 h		
Learning Steps			
Training Subjects	Theory Topics	Short Description	Duration (h)
2.1 Raw materials and additives	2.1.1. Characteristics of meat types for processed meat production (meat classes)	Raw meat materials for processed meat products; pork, beef, veal trimmings classes; meat raw materials from other species of slaughter animals – examples; mechanically separated meat; the role of proteins in meat products.	2
	2.1.2. Fat and offal as raw materials in meat preparation production	Fat raw materials; the role of fat in meat products; offal – definitions and examples; blood as an offal raw material; meat products produced using offal.	1.5
	2.1.3. Functional ingredients and additives for meat preparation production	Food additives; preservatives; acidity regulators; antioxidants; stabilizers and emulsifiers; flavour enhancers; thickening and gelling agents; non-meat complementary ingredients.	1.5

2.2. Traditional meat preservation methods	2.2.1. Drying	Aim of meat drying, examples of dried meat products, drying kinetics, methods of meat drying, biochemical reactions, health benefits of consuming dried meat products, and safety of dried meat products.	2
	2.2.2. Smoking	Aim of meat smoking; smoke composition; smoking methods; conventional smoking methods; novel smoking methods - friction smoke generation, liquid smoke, electrostatic, steam fluidization; alternatives to smoking	2
	2.2.3. Salting and curing	Salting; curing; the course of the curing process; ingredients of curing mixtures; colour shaping; bacteriostatic effect; shaping aroma and taste; antioxidant effect.	2
	2.2.4. Fermentation	Meat fermentation types; processes occurring during fermentation; microbial cultures used in meat fermentation	2
2.3. Units and equipment in meat processing	2.3.1. Curing	Curing methods; dry curing; wet curing (submersion); injection curing; combined methods	2
	2.3.2. Tumbling	The purpose and essence of the massaging process; tumblers; factors influencing the effectiveness of massaging; massaging procedure; over-massaging.	2
	2.3.3. Chopping, grinding and cutting	Purpose of shredding; machines; grinders; bowl cutters; cutting; emulsifiers.	1.5
	2.3.4. Mixing and stuffing	Mixing; stuffing; types of meat casings; natural casings; artificial casings; nets, textile casings, and spice casings.	1.5
	2.3.5. Heating and cooling	Aim of heat treatment of meat and meat products; microbial control; heat treatment of meat; types of heat treatment of meat products; physical and chemical changes occurring during heating; cooling; temperatures	2

		of cooking and cooling different processed meat products.	
2.4. Processed meat products	2.4.1. Fresh and cooked sausages	Definition and types of sausages; fresh sausages - meat and fat and non-meat components, production stages; cooked sausages - characteristics; components; production stages; texture formation.	1.5
	2.4.2. Raw-fermented sausages	Product characteristics; types of raw-fermented sausages; traditional making vs modern process; changes occurring during production; raw materials – meat and fat; non-meat ingredients; production stages.	1.5
	2.4.3. Dry-cured whole cuts products	General information; production stages, enzymatic reactions during ripening; health implications of dry-cured meats consumption; examples of dry-cured whole cuts.	1.5
	2.4.4. Cooked whole meat cuts	Product characteristics; whole meat cuts from entire muscles - production stages; reconstituted meat products; reconstituted meat products - production stages.	1.5
	2.4.5. Offal products (precooked-cooked meat products)	Definition and types of offal products; sensory requirements for offal products; general production stages of offal products; meat and fat used in offal products; pre-cooking; liver sausage/liver pate coarse-mixed and fine emulsion-like type; blood sausage/blood products; cooked gelatinous meat mixes.	1.5
	2.4.6. Pasteurised canned meat products	Definition and types of canned meat products; pasteurised canned meat products' characteristics; raw material; additives; changes occurring during pasteurization; production stages; sensory requirements.	1.5
	2.4.7. Sterilised canned meat products	Sterilized canned meat products' characteristics; the influence of sterilisation on product quality; canned block products; canned meat in its sauce; canned pate; canned fat.	1.5

	2.4.8. Other meat products	Meat products marinated with phosphates; restructured meat products using cold-set binders; convenience meat products.	1.5
Practical Part	<ul style="list-style-type: none"> ● Course 2 Lab Manual: <ol style="list-style-type: none"> 1. Analysis of sodium chloride content in meat products 2. Determination of the degree of reaction of meat dyes 3. Determination of nitrites content in meat products ● Making Process Manuals of: <ul style="list-style-type: none"> - Kaibala Biala PL - Kabanosy PL - Loukaniko GR - Siglino Manis GR - Prosciutto Crudo di Parma IT - Mortadella IT - Chorizo ES - Lacón ES - Androlla ES - Morcilla de León ES - Alheira PO <p style="text-align: center;"><i>– the link to it will be included once it is available in the moodle</i></p>		1
			12
Multimedia	<ul style="list-style-type: none"> ● Videos produced by InnoMeatEdu <ol style="list-style-type: none"> 1. Food Additives on Meat Production 2. Production of Italian Cooked Ham 3. Production of White Sausage 4. Production of Chicken Block 5. Production of Cecina (Dry-cured meat, Spain) 6. Reduced-meat sausage reformulated with chickpea ● Other videos <ol style="list-style-type: none"> 1. Injection of brine into meat (0.5 min.) https://youtube.com/shorts/BI6SAJhBNeA?si=scTn7fu1ZljzY4FD 2. Meat tumbling (2 min.) https://youtu.be/yDPc86hrJvY?si=I9fcBQA0AR9Hm7Oz 		

	<ol style="list-style-type: none"> 3. Meat grinding (3 min.) https://youtu.be/PwDfKTTphL0?si=xX499GonLeUjY4v 4. Bowl cutter (5.5 min) https://youtu.be/FldpcmnC3ME?si=j723pMbh8QT-Rj6E 5. Emulsifier (2.5 min) https://youtu.be/E-XegGnIm2M?si=WW7QhfkOBo5rs4mD 6. Sausage filling line (6 min; 1 min) https://youtu.be/0xxZQxiliI0?si=SN11yEj7aLBnMAa6 https://youtu.be/Pnle7yGEJ-E?si=n796veeEnvZpdgFy 7. Natural casings production (2 min) https://youtu.be/japgj6jRU3w?si=FA5SBrKjA3Rr_zr3 8. Small-scale ham production (7 min.) https://youtu.be/YpTX-BDDYW0?si=3YhTqPN_M6FH_6PA 9. Parma ham production (6 min.) https://youtu.be/IKHX72TAUVA?si=4ithxQEvclRzN10N 	
Other Useful Resources		
Further Reading	https://innomeatedu.unileon.es/course/section.php?id=139	

Learning Manual Course 3

COURSE 3	ADVANCES IN MEAT PROCESSING AND NOVEL MEAT PRODUCTS		
Learning Objectives	<p>At the end of this course students will have acquired knowledge on:</p> <ul style="list-style-type: none"> • understanding basic concepts in the area of novel technologies, • compile the main advances made in the application of innovative technologies in the microbiological safety, physicochemical characteristics, nutritional value and shelf life of meat products, • understanding novel strategies for developing healthy meat products, • understanding the advances in meat packaging and the importance to extend the shelf life of meat and meat products. <p>At the end of the course, students will be able to face questions related to the opportunities offered by the application of emerging technologies in the processing and packaging of meat products, as well as the development of healthier meat products to meet the expectations of a consumer increasingly concerned about what they eat and their health.</p>		
Learning Tools	PowerPoint presentations, multimedia, further reading, exercises, assessments		
Duration	26 (+25 h practical) = 51 h		
Learning Steps			
Training Subjects	Theory Topics	Short Description	Duration (h)
3.1. Emerging technologies in meat processing	3.1.1. Cold plasma	Fundamental concepts, theories and practices – Effects of their application in meat and meat products	2
	3.1.2. High pressure processing	Principles and mechanism of high pressure processing - Effects of their application in meat and meat products	2
	3.1.3. Infrared and light-based technologies	Fundamental concepts, theories and practices – Influence of treatment conditions, examples and case studies from the sector	2
	3.1.4. Ohmic heating and pulsed electric fields	Principles and mechanism - Effects of their application in meat and meat products	2

	3.1.5. Radio Frequency	Fundamental concepts, theories and practices – Influence of treatment conditions, examples and case studies from the sector	2
	3.1.6. Ultrasound	Principles and mechanism of ultrasound - Effects of their application in meat and meat products	2
3.2. Novel strategies for developing healthy meat products	3.2.1. Clean label meat products	Description of the natural alternative compounds that have the greatest potential to be used as preservatives in meat products	2
	3.2.2. Meat products as functional food	Incorporation of bioactive compounds (fiber, prebiotics, probiotics, vitamins, essential fatty acids, etc.) to obtain functional meat products	2
	3.2.3. Replacing animal fat with healthier lipids	Lipid bio-based materials in the reformulation of meat products, as well as their nutritional, technological, and sensorial implications	2
	3.2.4. Low-salt meat products	Alternatives to reduce salt content in the product without modifying its technological and sensory properties	2
3.3. Advances in meat packaging technology	3.3.1. Active packaging based in biopolymers and natural antioxidants	Description of the main antioxidant films and the principal manufacturing methods - Applications of antioxidant active packaging in meat industry	2
	3.3.2. Edible films/coatings	Preparation of edible films endowed with tailored properties for enhanced functionality. Benefits of edible films and coatings incorporated with natural extracts, essential oils, natural polymers, protein hydrolysates, enzymes, and nanocomponents to extend the shelf life of processed meat	2
	3.3.3. Biosensors and smart food	Active and intelligent functions incorporated in biodegradable films;	2

	packaging applications	either alone or in combination, to develop smart packaging.	
Practical Part	<ul style="list-style-type: none"> ● Course 3 Lab Manual <ol style="list-style-type: none"> 1. Extraction of bioactive compounds with Ultrasound Assisted Extraction 2. Extraction of bioactive compounds with Pulsed Electric Fields 3. Oil extraction with Supercritical Fluid Extraction 		25 h
Multimedia	<ul style="list-style-type: none"> ● Videos produced by InnoMeatEdu <ol style="list-style-type: none"> 1. Elaboration of Dry- Fermented Sausage with Quinoa Fat extracted by a Supercritical Fluid Equipment 2. Elaboration of Patties with Bioactive Compounds (BACs) of Sweet Potato Peels 3. Reduced-Meat Sausage Reformulated with chickpea ● Other videos <ol style="list-style-type: none"> 1. The first healthy meat burger in the world is created in Galicia - https://www.telecinco.es/informativos/salud/hamburguesa-carne-saludable-inventada-galicia_18_3094620120.html (1:24 minutes). 2. Usach Technologies Edible antioxidant coating for meats - https://www.youtube.com/watch?v=cwXo3qEjm8 (2:02 minutes). 		
Other Useful Resources			
References and Further Reading	https://innomeatedu.unileon.es/course/section.php?id=140		

Learning Manual Course 4

COURSE	SAFETY, QUALITY AND REGULATORY AFFAIRS		
Learning Objectives	<p>At the end of this course, students will have acquired knowledge on meat safety, quality and regulatory affairs. Students will be able to face issues related to meat safety and quality and will be capable of managing the meat sector regulatory framework.</p> <p>At the end of this course, students will have acquired knowledge and skills on safety issues of interest for the meat industry (food safety and risk analysis, including hygienic requirements of meat premises). They will also gain an understanding of key regulations in the meat sector concerning food safety, food information, novel foods, food contact materials and quality labels (PDO and PGI). In addition, some lessons will focus on the most relevant quality assurance schemes for the meat industries, along with tools for quality control, all aimed at ensuring the quality of the final products.</p> <ul style="list-style-type: none"> • European legislation (general and specific for the meat industry) • Food safety and risk analysis • HACCP applications for meat and meat derivatives. • Quality assurance from the stable to the table • Meat quality control 		
Learning Tools	<ul style="list-style-type: none"> - Theoretical and Practical info (powerpoint files) and Laboratory Manual - Interactive links with videos, e-books, case studies - Further readings - Infographics - Assessments 		
Duration	34 h (+ 12 h practical) = 46 h		
Learning Steps			
Training Subjects	Theory Topics	Short Description	Duration (h)
4.1 Regulatory framework on meat and meat products	4.1.1 Legislation on hygiene	Hygiene regulations on general requirements and specific rules for meat sector	2
	4.1.2 Mandatory food information to consumers (general labeling)	Food information to consumers with special attention to meat sector	2

	4.1.3 Voluntary food information to consumers (quality labels and others)	Description of quality labels -PDO and PGI on meat products; European procedures and databases.	1,5
	4.1.4 Nutrition and health claims	EFSA authorizations on particular claims: definitions, authorization procedures, public European register.	2
	4.1.5 Novel foods regulation	EFSA authorizations on novel foods: definitions, categories, authorization procedure, website to public European information.	2,5
	4.1.6 Food contact materials	General principles and requirements for materials and articles that come into contact with meat and meat products.	2
4.2. Meat and Meat Products Safety	4.2.1 Prerequisite programme for meat industry	An overview of the PRP, including staff training, equipment suitability and maintenance, hygienic design, cleaning and disinfection, pest management, water safety procedures etc	2
	4.2.2 Hazards: biological, chemical, physical and others	Introduction to safety hazards in the meat industry. Physical, biological and chemical hazards: sources. Incidence and occurrence data.	3
	4.2.3. Risk Analysis	Risk Analysis approach, focusing on risk assessment for developing a food safety management system	2
	4.2.4 HACCP applied to meat preparations	General procedures and application in the meat industry for the production of meat derivatives	2
	4.2.5. HACCP applied to meat products (sausages)	General procedures and application in the meat industry for the production of meat derivatives	2

	4.2.6. Microbiological Hazards identification/Predictive microbiology	Tools for food safety management in the meat industry	2
4.3. Meat Quality Control and Assurance	4.3.1 Quality assurance schemes for the meat industry from the stable to the table	An overview of schemes applied from livestock farming to meat production such as integrated management systems, organics, food safety management systems, quality assurance schemes related to standardization, environmental management systems, grass fed products, mountain/island products, fair trade products, halal and kosher meat and meat products, geographical indications on meat products.	3
	4.3.2 Quality Control	Understanding the significance of quality control in the meat industries and key principles, regulations, and industry standards that govern meat quality. Importance of maintaining consistency in sensory, physicochemical, and nutritional properties.	3
	4.3.3 Quality certification for meat and meat products	Understanding the steps for certifying quality characteristics. Presentation of special certifications of meat and meat products in different countries. Presentation of interactive map with certified meat and meat products across Europe	3
Practical Part	<ul style="list-style-type: none"> ● Course 4 Lab Manual <ol style="list-style-type: none"> 1. Web search for food additives: how to search for any additive authorized in the UE. 		12

	<ol style="list-style-type: none"> 2. Web search for quality labels: how to search for quality labels in the UE. 3. How to determine CCP using a decision tree. The determination of a CCP in the HACCP system can be facilitated by the application of a decision tree, which indicates a logic reasoning approach. 4. Risk Analysis Tools in the Meat Industry 5. HACCP verification Tools in the Meat Industry 6. Meat Products Quality Control (Nitrites, fat, protein, moisture) 7. Environmental Monitoring as a prerequisite for certification schemes in the meat industry 	
<p>Multimedia</p>	<ul style="list-style-type: none"> ● Videos of interest: 1. Food processing contaminants (EFSA) 3:39 min https://www.youtube.com/watch?v=yedloySByx4 2. Chemical contaminants in the food chain (EFSA) 3:26 min https://www.youtube.com/watch?v=CRZSsQt4tRY 3. Safe and nutritious food (EFSA) 0:42 min https://www.youtube.com/watch?v=fOCL6nPAKvQ 4. What are food-borne zoonotic pathogens? Why are they important for public health? (EFSA) 3:35 min https://www.youtube.com/watch?v=RV-lxADqsTY 5. EFSA explains risk assessment of food and feed risk 5:04 min https://www.youtube.com/watch?v=5xUhPmthgZk 	
<p>Other Useful Resources</p>		
<p>References and Further Reading</p>	<p>https://innomeatedu.unileon.es/course/section.php?id=141</p>	

Learning Manual Course 5

COURSE	ENVIRONMENTAL IMPACT OF MEAT PRODUCTION, CONSUMPTION AND SUSTAINABILITY IN THE MEAT SECTOR		
Learning Objectives	At the end of this course students will have acquired knowledge on the role of meat in the food system and impact meat production on the environment. Students will learn about alternatives for meat proteins.		
Learning Tools	Power point presentations, multimedia, further reading, exercises, assessments.		
Duration	22 h (+12 h practicals) = 34 h		
Learning Steps			
Training Subjects	Theory Topics	Short Description	Duration (h)
5.1. Role of meat in the food system	5.1.1. Nutritional value of meat and meat products and nutritional recommendation for meat consumption	Chemical composition of meat; The importance of meat in the diet; Nutritional recommendations - amount of consumption and variety; Meat processing - impact on nutritional value;	2
	5.1.2. Global and local meat consumption and its structure	Global meat consumption; Structure of meat consumption at the local level; Factors shaping meat consumption; Future perspective	2
	5.1.3. Relations between meat processing and other branches of industry	Importance of the meat industry in other industries; Meat processing by-products and their alternative uses; Benefits and threats resulting from the synergy of the meat industry with other industry sectors	1
5.2. Meat production in relation to energy and water consumption	5.2.1. Carbon footprint	Meat production, Greenhouse gases – global emissions, Greenhouse gases – types, Greenhouse gases – main sources, Greenhouse gases in agriculture, Carbon Footprint – CF, Carbon Footprint – LCA, Carbon Footprint of meat, A new approach.	3

	5.2.2. Water footprint	Definition, Types of water consumption, Water footprint - types Water footprint – values, units, The use of the water footprint indicator, How to calculate your water footprint? Water footprint of food, High water footprint of meat, Water footprint – examples.	2
5.3. Production systems of animals and its relation with the environment	5.3.1. Extensive, semi-intensive and intensive production system	Classification of Livestock systems, Criteria for environmental assessment of Livestock systems, Livestock systems and energy use, Livestock systems, land use and soil conservation, Livestock systems and air pollution, Livestock systems, water use and pollution, Livestock systems and biodiversity.	2
	5.3.2. Organic meat production – sustainability from field to fork on the example of a selected meat processing plant	Sustainability criteria for meat production, Definition and regulation of Organic meat production, Organic meat production systems and environment, Organics meat production systems and social impact, Limitations of organic meat production systems and profitability.	2
5.4. Alternatives for meat proteins	5.4.1. Cultured meat (lab-grown meat)	Alternatives for meat proteins, Cultured meat – definition, Evolution of cultured meat, Production CM – interdisciplinarity, Production CM – steps, Advantages of cultured meat Disadvantages/Challenges of cultured meat, The development, The future.	2
	5.4.2. 3D-printed meat	Definition, Legal regulations, What Is 3D-Printed Meat Made of? How Is 3D-Printed Meat Made? 3D meta production – reasons, Types of Alt-Meat That Can Be Created Using 3D Printing, Top 3D printed meat companies.	2
	5.4.3. Meat analogues	Plant-based meat analogues, Filamentous fungi-based meat analogues, Mushrooms-based meat analogues.	2

	5.4.4. Edible insects	Introduction, Nutritional composition, Proteins, Nutritional value, Anti-nutrients, Modern entomophagy, Safety aspects, Chemical hazard Microbial safety, Environmental, Why cricket?	2
Practical Part		<ul style="list-style-type: none"> ● Course 5 Lab Manual <ol style="list-style-type: none"> 1. Calculations of the student's environmental footprint 2. Characteristics and evaluation of innovative meat products: meat snack and meat analogue 	12
Multimedia		<ul style="list-style-type: none"> ● Videos produced by InnoMeatEdu <ol style="list-style-type: none"> 1. Black Pigs Wild Breeding ● Other videos: <ol style="list-style-type: none"> 1. How Meat Production Contributes to Climate Change (4:54) https://www.youtube.com/watch?v=GXjeQLoDXeA 2. The water footprint of the meat industry (1:54) https://www.youtube.com/watch?v=FlmEcDbf2qs 3. Understanding the 'water footprint' of beef (0:58) https://www.youtube.com/watch?v=gQcugp_ohlw 4. Overview of Intensive System of Cattle Farming (2:48) https://www.youtube.com/watch?v=ka1A8jCQbFA 5. What is Organic Farming? Agriculture Biology FuseSchool (3:50) https://www.youtube.com/watch?v=WhOriUlrnPo 6. Alternative Proteins - Is this the food of our future? (2:35) https://www.youtube.com/watch?v=ubczxoG6Nlo 7. The Meat of the Future: How Lab-Grown Meat Is Made (2:47) https://www.youtube.com/watch?v=u468xY1T8fw 8. How is cultivated meat (a.k.a. cultured meat) made exactly? (1:55) 9. https://www.youtube.com/watch?v=kG4EO-P93Dk 	

	<p>10. This 3D-Printed Meat Cuts Like Steak (1:21) https://www.youtube.com/watch?v=tXksi9gynQE</p> <p>11. Should we all be eating insects? - BBC REEL (4:56) https://www.youtube.com/watch?v=jtf4qRizIOg</p> <p>12. Extrusion of HMMA (High Moisture Meat Analogues) (2:27) https://www.youtube.com/watch?v=TsQWQtKuGy8</p>	
Other Useful Resources		
References and Further Reading	https://innomeatedu.unileon.es/course/section.php?id=143	

Learning Manual Course 6

COURSE 6	ENTREPRENEURSHIP/MARKETING		
Learning Objectives	<p>At the end of this course students will have acquired knowledge on</p> <ul style="list-style-type: none"> ● understanding basic concepts in the area of entrepreneurship, ● understanding the role and importance of entrepreneurship for economic development, ● developing personal creativity and entrepreneurial initiative ● adopting of the key steps in the elaboration of business idea ● understanding the stages of the entrepreneurial process and the resources needed for the successful development of entrepreneurial ventures. ● Understanding marketing as a process and a function ● Understanding the tools used for market segmentation and planning ● Understanding the elements of the marketing mix and their role in developing and delivering value to customers ● Understanding the importance of marketing in creating a sustainable competitive advantage <p>By the end of the course, students will be able to face issues regarding the opportunities and challenges one can face in today's rapidly changing business environment and how these shapes the whole entrepreneurial process.</p>		
Learning Tools	Power point presentations, multimedia, further reading, exercises, assessments.		
Duration	25 h (+25 h practical) = 50 h		
Learning Steps			
Training Subjects	Theory Topics	Short Description	Duration (h)
6.1. The entrepreneurial mindset: Strategies to continuously create opportunities.	6.1.1. Entrepreneurship defined	Fundamental concepts, theories, and practices employed in the field of entrepreneurship and the role entrepreneurship plays in the global economy and society – examples and case studies from the sector	4
	6.1.2. The traits of entrepreneur	A detailed analysis about the skill set expected from an aspiring entrepreneur	4

	6.1.3. Entrepreneurship is a team sport	Describe the new venture creation process — including the activities, challenges, and opportunities involved. The TRIM model, team building and leadership skills	4
6.2. The competitive advantage and the role of Strategies	6.2.1. Vision, mission, values and objectives	Description and creation of the fundamentals: the meaning and the importance of creating a clear mission - the difference between a company's mission and its values. Ways of building excellent objectives	4
	6.2.2. Useful tools: PESTEL, SWOT, 5 Forces	Analysis of the three tools: PESTEL, SWOT, 5 FORCES and their role in entrepreneurial decision making	5
	6.2.3. The role of technological change and innovation	Mastering Innovation: The nature of technological change and innovation. The importance of networking - open innovation.	4
6.3. The economics of the business concept	6.3.1. How to prepare a business plan	Rules for business survival: Definition of a business plan - distinguishing investment ventures, the need to prepare a business plan, parts and structure of a business plan, reliability of financial projections, business plan as a tool for controlling the operation of the business and obtaining financing	5
	6.3.2. Business Model Canvas	The value proposition as a foundation for business modelling: Reasoning about how an organisation creates, delivers, and captures value, low-cost and low-risk opportunities in business strategy, BMC as a plan from now to the future, value co-creation with stakeholders, sustainability and viability of a business model.	5
	6.3.3. Funding opportunities:	Financing of businesses and start-ups: Forms and types of financing, possibilities of private and public financing, selection of an appropriate financial instrument depending on	5

	options, costing methods	<p>the life cycle of the business/product/service, alternative ways of financing, resources, and critical points of financing innovation in the enterprise.</p> <p>Costing of production/operating a business: Distinguishing cost drivers, costing schemes based on the profile of the business, actual and accounting costs, maintaining liquidity and profitability, business value and viability.</p>	
6.4. Intro to Marketing	6.4.1. MARKET analysis: consumer trends, new consumer segments and niche markets	<p>a) market research within the relevant sector, potential markets and competitors: Segments, customer needs, growth potential, Five Forces model, opportunities and threats,</p> <p>b) customer analysis: target groups (primary – secondary research), value for money. Primary research and concept testing; how to prepare questionnaires specially designed for the purposes of the entrepreneur</p>	5
	6.4.2. Tools for Marketing: marketing mix, product placement, promotion and sales, pricing	Marketing and sales: Promotion, advertisement, distribution channels, sales plans, Pricing, customer management. A strategic and aggressive marketing plan is of significant importance.	5
Other Useful Resources			
References and Further Reading	https://innomeatedu.unileon.es/course/section.php?id=145		