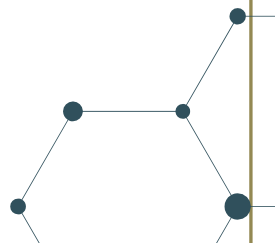


Professional Master in Dairy and
Meat Products Technology
programme

DMPT

MODULE HANDBOOK



 INSTITUT SUPÉRIEUR DE BIOTECHNOLOGIE DE BEJA المعهد العالي للتكنولوجيا البيولوجية	Module Handbook Dairy and Meat Products Technologies (DMPT)	ENR-CD-06 06/02/2023
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M1. Physiology of Lactation				
Module Name	UEF111: Physiology of Lactation			
Module level	1 st year			
Code	ECUEF111			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Slimen SELMI			
Lecturer	Slimen SELMI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S1
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	15-20 students	
	Workshops	3.5 hrs		
	PW	10.5 hrs	15-20 students	
Workload	Total	35 hrs	Self-study	40 hrs
	3		Coefficient	1.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
	- Animal Physiology - Nutrition - Food Microbiology			

Module Objectives	- In-depth knowledge of the fundamental principles of dairy physiology. - Deepen understanding of udder anatomy in dairy breeds. - Knowledge of lactation regulation mechanisms. - Simulate rumen fermentation using <i>in vitro</i> techniques (e.g. Daisy incubator).
Learning outcomes	The student will be able to: - Acquire in-depth knowledge of the anatomy of the mammary gland, with a focus on its specific structures and organization. - Analyze the pathogenesis of mammary infections, including their causes and their impact on milk production and quality. - Quantify and evaluate the digestibility rates of various feedstuffs to assess their nutritional value. - Critically analyze operational challenges (e.g., mastitis control, feed efficiency) and propose solutions to enhance milk quality. - Be able to carry out an experimental investigation under supervision and write a scientific report. - Evaluate microbial risks in dairy products. - Innovate uses for suboptimal raw milk.
Content	CHAPTER I: Anatomy and Physiology of the Mammary Gland I. Introduction II. The Mammary Gland - II.1. Anatomy - II.2. Organization III. The Teat - III.1. Anatomy

III.2. Teat in Cows

CHAPTER II: Development of the Mammary Gland

I. Introduction

II. Mammogenesis

III. Lactogenesis

IV. Galactopoiesis

V. Mammary Involution: Dry Period

CHAPTER III: Mastitis

I. Introduction

II. Classification

III. Significance of Mastitis

IV. Pathogenesis of Mammary Infections

CHAPTER IV: Mechanisms of Lactation Regulation

I. Introduction

II. Hormonal Control of Mammogenesis

III. Lactogenesis

III.1. Lactogenic Hormones

III.2. Mechanism of Action of Lactogenic Hormones

IV. Lactation

IV.1. Secretion Mechanisms

IV.2. Hormonal Control of Lactation

Practical Work :

PW 1: Measurement of lactose as an indicator of energy deficiency in dairy cows.

PW 2: Composition and energy balance of milk.

PW 3: Impact of different dietary ratios on milk quality.

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows:	
	Written mid-term exam	10%
	Practical works	20%
	Written final exam	70%
	Quiz/QCM at the end of each main chapter	0%
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	
Reading list	▪ "Physiology of Lactation" by J. Djiane and F. Lescure-Meunier. ▪ "Mammary Gland Development: Methods and Protocols" by Paul H. G. Simon. ▪ "Lactation: Physiology, Nutrition, and Breast-Feeding" by Michael E. Reese and Sarah A. Keim.	

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M2. Dairy breeds health and management

Module Name	Dairy breeds health and management				
Module level	1 st year				
Code	EUF112				
Semester(s) in which the module is taught	Semester 1 (S1)				
Person responsible for the module	Slimen SELMI				
Lecturer	Moez AYADI				
	Abir MAALAWI				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	DMPT		x		S1
			x		S1
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		21 hrs	15-20 students	
	Workshop				
	PW		14 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	45 hrs	
Credit points	3		Coefficient	1.5	
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams				
Recommended prerequisites	- Livestock Production (or equivalent) - Livestock Reproductive Technologies (or equivalent)				

Module Objectives

- Understand Dairy Farm Economics & Management
- Master Breeding & Lactation Management
- Optimize Milking & Udder Health Practices
- Enhance Nutrition & Disease Control Strategies
- Describe the main characteristics and production aptitudes of different breeds of cattle, sheep, and goats used in dairy production.

Learning outcomes

- Compare and analyze the different dairy production systems (extensive, semi-intensive, intensive) and their impacts on milk yield and quality.
- Assess and improve milking management practices to optimize hygiene, milk yield, and animal welfare.
- Diagnose common mastitis types and foot pathologies in dairy ruminants and propose practical prevention or treatment measures.
- Evaluate the factors affecting milk yield and quality and propose solutions to improve them.
- Retrieve, analyze and interpret information from diverse scientific and technical sources to solve real-life problems in dairy production and processing.
- Assess key health and management practices to prevent milk spoilage and ensure compliance with quality standards.

CHAPTER I: Dairy economy

- Profitability of dairy farms
- Cost of milk production in dairy ruminants (variation factors)

CHAPTER II: Dairy breeds and production systems

- Breeds of cattle, sheep, goats and camels
- Dairy cattle breeding systems in the world and in Tunisia
- Breeding system for small ruminants (sheep and goats)

CHAPTER III: Identification of livestock

- The benefit of identifying livestock
- Identification methods (manual and electronic)
- Identification of animals in Tunisia.

CHAPTER IV: Breeding management of young animal and heifers

- Management of young animal
- Management of heifers

CHAPTER V: Lactation in ruminants

- Oxytocin rerelease and neuroendocrine milk ejection reflex
- Milk production process
- Milk quality
- Lactation curve
- Milk recording system
- Factors of variation in milk production

CHAPTER VI: Milking management and udder health

- Milking behaviour in dairy ruminants
- Suitability of animals for machine milking
- Milk quality criteria (bacteriological and physicochemical)
- Optimize milking frequency in dairy ruminants
- Factors affecting the incidence of mastitis
- Techniques for detecting subclinical mastitis in dairy ruminants.

CHAPTER VII: Feeding of dairy ruminants

- Dietary requirements
- Forage calendar
- CHAPTER VIII: Pathologies in dairy ruminants
- Foot pathology (lameness)
- Tuberculosis in cows
- Brucellosis in cows
- National program to combat brucellosis and tuberculosis in Tunisia

Practical Work :

- PW 1: Assessment of the nutritional quality of animal feed
- PW 2: Comparison of the nutritional value between cow and sheep's milk
- PW 3: Visit to a dairy breeds farm

Mixed evaluation
The final score is weighted as follows:

Written mid-term exam	10%
Practical works	20%
Written final exam	70%
Quiz/QCM at the end of each main chapter	0%

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing Analysis and synthesis of scientific articles on milk production in ruminants (group work).
Reading list	▪ Labussière J. 1988. Organisation de la traite et perspectives de simplification. In: La production laitière française. INRA Publ., Versailles. p. 308-318 ▪ Ayadi, M. 2015. Amélioration de la production laitière chez les ruminants. Mémoire en vue de l'obtention du diplôme d'habilitation à diriger des recherches. Université de Jendouba, Tunisie. 187 pp. ▪ Ayadi, M. 2019. Optimization of milking frequency in dairy ruminants. In: Lactation in Farm Animals-Biology, Physiological Basis, Nutritional Requirements, and Modelization. Intech Open Editions, London.13p. ▪ Brahmi, E. ; Soltani, N. ; Souli, A. ; Ben Attia, M. ; Ayadi, M. 2023. Evaluation of the productive and reproductive performance of Holstein dairy cows reared in a warm Tunisian (Mediterranean) climate. Journal of New Sciences, Agriculture and Biotechnology 91(1): 5139-5149. ▪ Brahmi, E. Souli, A., Maroini, M., Abid, I., Ben-Attia, M., Salama, A.A.K. and Ayadi. M. 2024. Seasonal variations of physiological responses, milk production and milk fatty acid profile of local crossbred cows in Tunisia. Tropical Animal Health and Production 56 (11): 1-9. https://doi.org/10.1007/s11250-023-03851-6

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M3. Milk microbiology

Module Name	Milk microbiology				
Module level	1 st year				
Code	UEF121				
Semester(s) in which the module is taught	Semester 1 (S1)				
Person responsible for the module	Sana M’HIR				
Lecturer	Sana M’HIR				
	Arij Mechrgui				
Language	English/French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	DMPT		x		S1
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		21 hrs	15-25 students	
	Workshop		3,5 hrs	15-25 students	
	PW		10,5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	45 hrs	
Credit points	3		Coefficient	1,5	
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams				
Recommended prerequisites	General microbiology				

Module Objectives

- Recognize the factors that promote the growth of microorganisms in milk and milk products;
- Identify the pathogenic and spoilage microbe groups in milk and milk products;
- Identify the diversity of the milk microflora and its significance.
- Describe a few indirect and molecular methods that allow this diversity to be studied.

Learning outcomes

- Analyze the microorganisms involved in the spoilage of milk and dairy products
- Evaluate the intrinsic and extrinsic factors that lead to the alteration of milk and dairy products.
- Possess comprehensive knowledge on good practices and safety applied to dairy products.
- Analyze the pathogenic microorganisms linked to dairy products that cause food poisoning.
- Have in depth knowledge in milk microbiology and explore microflora diversity of raw milk
- Apply advanced knowledge to experimentally determine and analyze the microflora and the pathogenic microorganisms in milk and milk products.
- Conveying scientific information and safety considerations in a clear and concise manner.

Content

CHAPTER I: Basic concepts in food microbiology

CHAPTER II: Microbiology of raw milk

- Substances inherent to milk that are antimicrobial.
- Factors that promote microbial growth

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- The "keeping quality" factor of raw milk
 - Indigenous and contaminated flora
 - Techniques for evaluating microbiological quality
 - Main microbial activities in milk, biofilm
 - Microbial fluxes in dairy production

CHAPTER III: Milk microflora and biodiversity

- Diversity of microorganisms associated with raw milk

CHAPTER IV: Microbiology of dairy products

- Microbiology of heated milk
- microbiology of cream
- Microbiology of butter
- Microbiology of ice Cream
- Microbiology of condensed and sweetened milk
- Microbiology of powdered milk
-

CHAPTER V: Pathogens associated with dairy products

CHAPTER VI: Application of molecular methods to identify microorganisms associated with dairy products

CHAPTER VII: Bacteriophages

General characteristics

Phages in dairy environments

Means of control and fight

Practical work:

- PW1: Microbiological analysis of milk
- PW2: Microbiological analysis of Yogurt and cheese
- PW3: Enumeration of butyric in milk
- PW4: On site visit to the agricultural and food industries

Workshops:

Article analysis related to :

Workshop 1: Microflora distribution and assessment of microbiological quality milk from Tunisian collection centres

Workshop 2: Microbiology of milk: Public health aspect

The Pharma Innovation Journal 2018; 7(1): 260-264

Workshop 3: Evaluating the effect of storage conditions on milk microbiological quality and composition

Workshop 4: Biofilm Formation in Milk Production and Processing Environments; Influence on Milk Quality and Safety

Interactive session: « coliformes in dairy industry »: The evolving role of coliforms as indicators of unhygienic Processing conditions in dairy foods

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	5%
	Practical works	20%
	Written final exam	70%
	Quiz/QCM at the end of each main chapter	2%
Media employed	Flipped classroom teaching method	3%
	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	

- Microbiologie alimentaire, Joseph-Pierre Guiraud. DUNOD. ISBN 210 0072595
- Microbiologie et qualité dans les industries agroalimentaires, Sciences des aliments, Guy Leyral, ISBN 2-86617-395-5
- Microbiologie et toxicologie des aliments, Hygiène et sécurité alimentaire, ISBN 9786267040-1233-6
- Fundamental food microbiology, CRC press, ISBN 0-8493-1610-3
- Techniques de l'ingénieur : Méthodes de détection rapide en microbiologie alimentaire, F1 130
- Techniques de l'ingénieur : Sécurité microbiologique des procédés alimentaires, F1 120
- Pratique en microbiologie de laboratoire, recherche de bactéries et de levures-moisissures, Camille Delarras, 2014, ISBN : 978-2-7430-1565-7, 772 p.
- Psychrotrophic bacteria and milk and dairy products quality, Mljekarstvo, 2012, 62, 77-95.
- Pathogens in milk, Encyclopedia of Dairy Sciences, Patrik F.Fox and Paul L.H. McSweeney, 2011, Elsevier. ISBN:978-0-12-374402-9

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M4. Microbiology of meat products

Module Name	Microbiology of meat products			
Module level	1 st year			
Code	UEF122			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Sana M'HIR			
Lecturer	Sana M'HIR			
Language	English/French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S1
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	15-25 students	
	Workshops	3,5 hrs	15-25 students	
	PW	10,5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	45 hrs
Credit points	3	Coefficient	1,5	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	General microbiology (or equivalent)			

Module Objectives

- Analyze the microbiological groups involved in of meat products spoilage;
- Research the microbiology of various meat products, such as fish products, fermented meat, and poultry.
- Understand the role of microflora in the spoilage of meat products.
- Recognize hurdles technologies applied to meat products.

Learning outcomes

- Recognize the microflora of various meat products, such as poultry, fish, and fermented meat;
- Analyze the microorganisms involved in the spoilage of meat and meat products;
- Evaluate the intrinsic and extrinsic factors that lead to the alteration of meat and meat products;
- Identify and analyze the pathogenic microorganisms that cause meat products poisoning;
- Possess knowledge of regulatory requirements and good practices applicable to meat products, ensuring compliance and consumer safety.
- Use advanced methods of scientific investigation to research microbiological, chemical and physical properties of dairy and meat products, ensuring rigorous data collection, analysis and interpretation.
- Be able to plan and communicate effectively in a professional manner and to write a scientific report with scientific recommendations.

Content

CHAPTER I: Introduction to meat microbiology

- Hurdles technologies applied to meat and meat products

CHAPTER II: microbiology of meat-concept of ecosystem

- Microbial metabolism and its effects
- specific spoilage microorganisms
- Spoilage microorganisms: *Enterobacteriaceae*, *Pseudomonas*, Lactic acid bacteria, and *Brochotrix*

- Pathogens : *Salmonella*, *Yersinia*, *Escherichia coli*, *Aeromonas hydrophila*, and *Listeria*.
- Factors that affect spoilage

CHAPTER III: spoilage of meat and meat products

- Fresh meat
- Minced meat
- Packaged meat
- Meat products
- Preservation of meat and meat products

CHAPTER IV: poultry meats

- Contamination
- Spoilage
- Means of preserving

CHAPTER V: Microbiology of fish and seafood products

- Contamination
- Spoilage
- Means of preserving

CHAPTER VI: Microbiology of fermented meat products

- Tunisian traditional salted meat
- kadid
- Dried Osben
- Dried sausage
- rôle des cultures starters

Practical work:

- **PW1:** Research and enumeration of Total Mesophilic Aerobic Germs (GAMT), total coliforms, thermotolerant coliforms.
- **PW2:** Research and enumeration of *Pseudomonas aeruginosa* and *Salmonella*
- **PW3:** Research and enumeration of *Staphylococcus*, *Clostridium*
- On site visit to the agricultural and food industries

Workshops:

WS 1: Article analysis related to Microbial Quality Assessment of Processed Meat Product

WS 2: Article analysis related to Meat spoilage microbiota and associated volatile organic compounds at different storage temperatures and packaging conditions

WS 3: Article analysis related to the Characterization and technological properties of *Staphylococcus xylosus* strains isolated from salted meat products.

WS 4: contamination levels of *Clostridium* spores that result in gaseous spoilage of vacuum-packaged chilled beef

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	5%
	Practical works	20%
	Written final exam	70%
	Quiz/QCM at the end of each main chapter	2%
Media employed	Flipped classroom teaching method	
	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	
Reading list	● Microbiologie Alimentaire, Joseph-Pierre Guiraud. DUNOD. ISBN 210 0072595	
	● Microbiologie et qualité dans les industries agroalimentaires, Sciences des aliments, Guy Leyral, ISBN 2-86617-395-5	
	● Microbiologie et toxicologie des aliments, Hygiène et sécurité alimentaire,	

ISBN 9786267040-1233-6

- Fundamental food microbiology, CRC press, ISBN 0-8493-1610-3
 - Techniques de l'ingénieur : Méthodes de détection rapide en microbiologie alimentaire, F1 130
 - Techniques de l'ingénieur : Sécurité microbiologique des procédés alimentaires, F1 120
 - Pratique en microbiologie de laboratoire, recherche de bactéries et de levures-moisissures, Camille Delarras, 2014, ISBN : 978-2-7430-1565-7, 772 p.
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M5. Industrial Hygiene, Safety and Environment

Module Name	Industrial hygiene, Safety and Environment				
Module level	1 st year				
Code	UEF131				
Semester(s) in which the module is taught	Semester 1 (S1)				
Person responsible for the module	Mourad Jridi				
Lecturer	Atef Hasni				
	Mohamed Allouche				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	DMPT		x		S1
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		21 hrs	20 students	
	Workshops		3.5 hrs		
	PW		10.5 hrs	20 students	
Workload	Total	35 hrs	Self-study	40 hrs	
Credit points	3		Coefficient	1.5	
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams				
Recommended prerequisites	- Quality control management (or equivalent) - Food legislation (or equivalent) - Hygiene in food industry (or equivalent)				

Module Objectives

- Application of the HACCP method in the agri-food industry
- Identify biological, physical and chemical risks

Learning outcomes

- Understand the importance of hygiene and the principles of quality management systems in the food industry, the documentation required and its use;
- Apply the HACCP method in the agri-food industry;
- Have a deep knowledge of quality standards and good practices applicable to dairy and meat industries, ensuring compliance and consumer safety;
- Apply good hygiene practices and implement principles of cleaning and sanitation within dairy and meat processing environments ;
- Understand the role of hygiene and cleaning in quality assurance, waste streams management and regulatory compliance;
- Identify and differentiate between biological, physical and chemical risks, and critically evaluate the influence of intrinsic and extrinsic factors on food quality in dairy and meat products, including spoilage and pathogenic organisms, toxins and preservation methods;

- Demonstrate a critical understanding of the role of food provenance in maintaining food quality.

Content

CHAPTER I: Importance of hygiene

- Importance of hygiene and risk analysis methods
- Risk analysis and prevention in the context of quality standards
- Basic principles of hygiene (production and packaging)
- Importance of respecting the cold chain

CHAPTER II : HACCP risk analysis

- Risk analysis methodology(ies)
- Definition of the HACCP method
- Basic principles of HACCP
- Case study: Application of the HACCP method to a market-garden crop
- Limits of HACCP

CHAPTER III: Biological risks

- Biological risks
- Description of important organisms
- Prevention of biological risks
- Special case of water quality (irrigation and cleaning)

CHAPTER IV: Physical risks

- Physical risks
- Nature of risks
- Prevention of physical risks

CHAPTER V : Chemical risks

- Chemical risks
- Risks of contamination by MTEs
- Risks associated with the use of pesticides
- Importance of MRL and GAP regulations

CHAPTER VI : Hygiene in the field and in the station

- Hygiene in the field
- Hygiene at the packing station
- Hygiene during transport and handling
- Organisation of packing stations
- Staff hygiene
- Hygiene of containers and packaging

CHAPTER VII : Importance of the cold chain

- Importance of the cold chain
- Hygiene of packaged rooms
- Maintenance and checking of cold rooms

Workshops

- **WS 1:** Internal Audit PRP in milk collection center (case study)
- **WS 2:** Prepare a health approval in milk industry

Practical Work

- **PW 1:** Implementation and application of good hygiene practices in a laboratory
- **PW 2:** Safety and assessment of physical, chemical and microbiological risks
- **PW 3 :** Visit to a milk collection center (case study)

Study and examination requirements and forms

Mixed evaluation
The final score is weighted as follows:

of examination	
	Written mid-term exam 10%
	Practical works 20%
	Written final exam 70%
	Quiz/QCM at the end of each main chapter 0%
Media employed	Digital presentations
Reading list	https://youtube.com/watch?v=Tr3yaEXGHiU&si=45z6Qwz2_PKqMjO4 Base de donnée européenne : http://europa.eu.int/comm/food/fs/ph_ps/pest/index_en.htm Base de données du Codex Alimentarius : http://apps.fao.org/CodexSystem/pestdes/pest_q-e.htm Base de données du CFCE : http://www.cfce.fr/cfce/bdd/index_bdd.html

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M6. Food Safety Management: Standardization, Legislation and Traceability				
Module Name	Food Safety Management: Standardization, Legislation and Traceability			
Module level	1 st year			
Code	UEF130			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Mourad JRIDI			
Lecturer	Marwa AMRI			
Language	French/English			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S1
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	10-20 Students	
	Workshop	7 hrs		
	PW	7 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	40 hrs
Credit points	3	Coefficient	1.5	
Requirements according to the examination regulations	▪ Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	▪ Management quality system (or equivalent) ▪ Food legislation (or equivalent)			

Module Objectives	- Implement Traceability Systems : Design farm-to-fork traceability protocols; Apply digital tools (e.g., SAP, LIMS) for real-time supply chain monitoring; Develop Audit Competence; Conduct HACCP/ISO 22000 audits and mock recalls; Interpret non-compliance risks (legal, financial, reputational). - Combines legal expertise + technical traceability tools: It also involves keeping the student abreast of legal developments by health and safety and teach the current legislative framework that exists throughout national and international (Tunisian, European and global).
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Learning outcomes	- Implement principles of hygiene, cleaning and sanitation within dairy and meat processing environments, understanding their role in quality assurance, waste management and regulatory compliance. - Undertake an analysis demonstrating how a food product can be authenticated. - Understand the principles of quality management systems in the food industry, - Describe the legal framework that applies to artisan and industry foods, the principle legal requirements and the penalties that can be applied within a defined jurisdiction. - Communicate effectively with multidisciplinary teams in national and international context, conveying complex scientific information, technical findings and safety considerations in a clear, concise and professional manner. - Possess comprehensive knowledge of legal and regulatory requirements, quality standards and good practices applicable to dairy and meat industries, ensuring compliance and consumer safety. - Utilize advanced analytical tools to design and assess processing systems, ensuring product integrity, shelf-life and compliance with regulatory standards.
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Content	Chapter 1: Legislation and regulations - Regulatory constraints and principles - European regulations - U.S. regulations - Regulatory principles 4.1. Food additives
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- 4.2. Food categories
 - 5. National regulations
 - 5.1. Regulations on milk substitutes
 - 5.2 Tunisian legislation: production and marketing of artisanal dairy products
 - 5.3. Tunisian legislation: production and marketing of artisanal meat products
 - 5.4. Additives in Tunisian artisanal products

Chapter 2: National and international standards

- 1. National standardization
- 2. International standardization
- 3. European standardization

Chapter 3: Traceability

- 1. Basic concepts and food industry issues.
 - 1.1. Definitions and basic concepts.
 - 1.2. The rise of agri-food traceability.
 - 1.3. Typology of traceability challenges in the food industry.
- 2. How do food companies implement traceability?
 - 2.1. Internal diagnostics.
 - 2.2 Methodology for diagnosing internal traceability.
 - Traceability case studies.
 - Feedback and assessment of case studies.
- 3. A global traceability approach and progress tools to improve safety and product quality products.
 - Global traceability approach.
 - Global traceability audit principle.
 - Case study.

Chapter 4: Food risk management

- 1 Definition and background
- 2 Action by political authorities
- 3 Action by administrative authorities
 - 3-1 Administrative organization
 - 3-2 Drafting regulations
 - 3-3 Contractual measures recognized by public authorities
 - 3-4 Control and legal action
- 5 Risk management in crisis situations
- 4 Corporate action
 - 4-1 Background
 - 4-2 Risk prevention
 - 4-3 Traceability
 - 4-4 Corporate crisis management
- 5 Consumer action
- 6 Risk communication

P/TD plan - Tutorial sessions :

- Presentations on legislation and fraud control :
- National and international legislation and regulations
 - Traceability and risk control through the HACCP system
 - International regulations on genetically modified organisms GMOs
 - Food risk management

Practical sessions :

Practical exercise 1: Application of bottom-up and top-down traceability methods: the case of milk

Practical exercise 2: Collection of Tunisian legislative texts for industrial and traditional foods

Field trip: INNORPI visit/Factory visit

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	10%
	Practical works	20%
	Written final exam	70%
	Quiz/QCM at the end of each main chapter	0%

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	▪ https://www.innorpi.tn/ ▪ https://www.iso.org/fr/home.html ▪ BRCG site

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M7. Livestock production

Module Name	UEO111: Livestock production			
Module level	1 st year			
Code	UEO111			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Slimen SELMI			
Lecturer	Moez AYADI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT		x	S1
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	15-20 students	
	Workshop	7 hrs		
	PW		15-20 students	
Workload	Total	28 hrs	Self-study	50 hrs
Credit points	3	Coefficient	.5	
Requirements according to the examination regulations	▪ Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	▪ Animal Biology and Physiology ▪ Nutrition ▪ Reproduction and Genetics ▪ Economics and Management			

Module Objectives

- Develop a comprehensive understanding of the anatomy, physiology, and reproductive systems of various livestock species to inform effective management and care practices.
- Acquire practical knowledge and skills in the day-to-day management of livestock, including housing, feeding, breeding, and health care, to ensure optimal animal welfare and productivity.
- Learn to create and implement nutritionally balanced diets tailored to the specific needs of different livestock species, considering factors such as growth stages, production levels, and health conditions.
- Understand common livestock diseases, their prevention, and treatment methods, and develop skills in implementing effective biosecurity measures to minimize the risk of disease outbreaks.
- Explore and apply principles of sustainability in livestock production, including environmental stewardship, efficient resource use, and practices that enhance the long-term viability of livestock operations.
- Gain proficiency in conducting economic analyses related to livestock production, understanding market dynamics, and developing strategies to enhance the profitability and marketability of livestock products.

Learning outcomes

- Be able to formulate balanced diets and understand the nutritional requirements of different livestock species, taking into account factors such as age, production stage, and health status.
- Acquire knowledge about common diseases affecting livestock, preventive measures, and treatment options. They will also learn about biosecurity practices to prevent disease outbreaks.
- Understand the principles of sustainable livestock production, including environmental impacts, resource management, and strategies to enhance the sustainability of livestock systems.
- Develop skills in economic analysis related to livestock production, including cost-benefit analysis, market trends, and strategies for improving profitability and marketability of livestock products.
- Analyze and evaluate the impact of intrinsic and extrinsic factors on the shelf-life and safety of dairy and meat products, using predictive modeling to propose optimization strategies.
- Develop innovative solutions for the valorization of lower-quality raw materials in dairy and meat processing, ensuring economic viability while maintaining product quality and safety.

Content

Chapter I: Production and Rearing of Dairy Cows

- Introduction
- Section I: The Different Breeds of Dairy Cows
- Section II: Feeding Dairy Cows
- Section III: Managing Reproduction in Dairy Cows
- Section IV: Housing for Dairy Cows
- Section V: Health of Dairy Cows
- Section VI: Milking Dairy Cows

Chapter II: Production and Rearing of Veal Calves

- Introduction
- Section I: Feeding Management
- Section II: Methods of Feed Distribution
- Section III: Feeding Plans
- Section IV: Feeding Hygiene

Chapter III: Production and Rearing of Sheep

- Introduction
- Section I: Feeding Ewes and Rams
- Section II: Managing Reproduction

Chapter IV: Production and Rearing of Goats

- Introduction
- Section I: Feeding Goats
- Section II: Managing Reproduction

Chapter V: Production and Rearing of Poultry

- Introduction
- Section I: Nutritional Quality Requirements and Their Impact on Rearing
- Section II: Formation and Composition of the Egg
- Section III: Formation of the Egg Shell
- Section IV: Mineral Supplementation
- Section V: Vitamin Supplementation
- Section VI: Water Quality
- Section VII: Feed Additives
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Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table> <tr> <td>Written mid-term exam</td><td>10%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td>Written final exam</td><td>70%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>0%</td></tr> </table>	Written mid-term exam	10%	Practical works	20%	Written final exam	70%	Quiz/QCM at the end of each main chapter	0%
Written mid-term exam	10%								
Practical works	20%								
Written final exam	70%								
Quiz/QCM at the end of each main chapter	0%								
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	▪ "Animal Science and Industry" by Merle D. Cunningham, Robert L. Knipe, and H. Allen Smith ▪ "Livestock Production and Management" by N. S. R. Sastry and C. K. Thomas ▪ "Principles of Animal Agriculture" by John R. Campbell and Robert T. Marshall ▪ Applied Animal Nutrition: Feeds and feeding" by Peter R. Cheeke ▪ Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs, and Goats" by Otto M. Radostits, Clive C. Gay, Kenneth W. Hinchcliff, and Peter D. Constable								

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M8. Embryonic development

Module Name	UEO112: Embryonic development				
Module level	1 st year				
Code	UEO112				
Semester(s) in which the module is taught	Semester 1 (S1)				
Person responsible for the module	Slimen Selmi				
Lecturer	Mohamed Amine Jabri				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	DMPT			x	S1
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		21 hrs	15-20 students	
	Workshop		3.5 hrs		
	PW		10.5 hrs	15-20 students	
Workload	Total		35 hrs	Self-study	40 hrs
Credit points	3			Coefficient	1.5
Requirements according to the examination regulations	▪ Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams				
Recommended prerequisites	▪ Animal Physiology ▪ Basic Biology and Genetics ▪ Biotechnology ▪ Ethics and Regulations				

Module Objectives

- Critically evaluate the economic, scientific, and medical applications of reproductive biotechnologies in animal agriculture, veterinary medicine, and biomedical research.
- Analyze and discuss ethical considerations and regulatory frameworks governing the use of reproductive biotechnologies in animal breeding and research.
- Develop practical skills through laboratory sessions and hands-on activities focused on assessing embryonic viability, sexing gametes, and conducting transgenic experiments.
- Interpret and analyze current research literature and case studies related to advancements and applications in reproductive biotechnologies in animals.
- Communicate scientific concepts, experimental findings, and ethical considerations related to reproductive biotechnologies effectively in oral and written formats.
- Apply acquired knowledge and critical thinking skills to solve problems related to the implementation and improvement of reproductive biotechnologies in animal science.
- Work collaboratively and ethically in team settings to explore and discuss complex issues and challenges in reproductive biotechnologies.

Learning outcomes

- Evaluate different methods for embryonic sexing and justify their importance in agricultural and biomedical applications.
- Assess the principles and outcomes of embryonic cloning techniques, including their performance metrics and the characteristics of cloned animals.
- Explain the concept of transgenesis and its economic, scientific, and medical implications, comparing various gene transfer methods and applications.
- Analyze ethical considerations and regulatory frameworks surrounding the use of reproductive biotechnologies in animal breeding and research.
- Develop practical skills through laboratory sessions focused on assessing embryonic viability, sexing gametes, and conducting targeted transgenesis experiments.
- Analyze the impact of embryonic development in dairy and meat products, and evaluate predictive modeling applications for quality control.
- Develop innovative strategies to utilize lower-quality raw materials in embryonic development processes, ensuring safety and extending shelf life.

Content

Chapter I: *In vitro* Embryonic Development

- Introduction
- Section I: Early Stages of Embryogenesis
- Section II: In Vitro Blockage Stage of Embryonic Development
- Section III: Embryonic Development Technology
- Section IV: Assessment of In Vitro Embryonic Viability
- Section V: Preimplantation Genetic Diagnosis (PGD)

Chapter II: Embryonic Sexing

- Introduction
- Section I: Economic Importance
- Section II: Sorting of Male and Female Gametes
- Section III: Various Techniques of Embryo Sexing

Chapter III: Embryonic Cloning

- Introduction
- Section I: Principle of Cloning by Embryonic Transfer
- Section II: Cloning Performances
- Section III: Characteristics of Cloned Animals

Chapter IV: Animal Transgenesis

- Introduction
- Section I: Definition
- Section II: Economic, Scientific, and Medical Importance of Transgenesis
- Section III: Principle of Obtaining a Transgenic Animal
- Section IV: Gene Transfer Methods
- Section V: Targeted Transgenesis
- Section VI: Transfer of Nuclei from Genetically Modified Cells
- Section VII: Applications of Transgenesis

Labwork

- Lab 1: Study of *in vitro* Embryonic Viability
- Lab 2: Screening of Male and Female Gametes
- Lab 3: Targeted Transgenesis

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table> <tr> <td>Written mid-term exam</td><td>10%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td>Written final exam</td><td>70%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>0%</td></tr> </table>	Written mid-term exam	10%	Practical works	20%	Written final exam	70%	Quiz/QCM at the end of each main chapter	0%
Written mid-term exam	10%								
Practical works	20%								
Written final exam	70%								
Quiz/QCM at the end of each main chapter	0%								
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	▪ "Reproductive Biotechnology in Finfish Aquaculture" by G. S. Saharan and Anil Kumar Verma ▪ "Handbook of Embryo Transfer" by Jadwiga A. Daszkiewicz and Jane M. Morrell								

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M9. Scientific English

Module Name	UET111: Scientific English				
Module level	1 st year				
Code	UET111				
Semester(s) in which the module is taught	Semester 1 (S1)				
Person responsible for the module	Narimen KAMEL				
Lecturer	Narimen KAMEL				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	DMPT		x		S1
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Integrated Course		21 hrs	15-20 students	
	Workshop				
	PW				
Workload	Total	21 hrs	Self-study	30 hrs	
Credit points	3		Coefficient	.5	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams				
Recommended prerequisites	- Basic English - Informatics				

Module Objectives

- Understand and apply the fundamentals of scientific writing, with a focus on clarity, precision, grammar, and appropriate structure.
- Build and use a robust scientific vocabulary to communicate effectively in written and oral forms.
- Structure scientific documents using the IMRAD format, including writing abstracts, introductions, methods, results and discussions. Read, summarize, and critique scientific literature to support critical thinking and writing development.
- Design and present scientific content effectively through posters and oral presentations

Learning outcomes

- Understand the purpose and importance of scientific communication.
- Identify the characteristics of effective scientific writing.
- Apply grammatical rules specific to scientific writing.
- Expand scientific vocabulary to accurately convey ideas and concepts.
- Structure and organize scientific papers following the IMRAD format.
- Write clear and concise abstracts, introductions, methods sections, results, and discussions.
- Analyze and critically evaluate scientific literature.
- Summarize and synthesize information from research articles.
- Design and create effective scientific posters.
- Effectively communicate and discuss scientific ideas through oral presentations to different audiences.
- Write professional emails and formal letters for various scientific purposes.

- Respond appropriately to reviewers' comments and editorial feedback.

Content

Introduction to Scientific Communication

- Overview of scientific writing and communication skills.
- Importance of clarity, precision, and structure in scientific English.

Grammar and Vocabulary for Science

- Grammar rules specific to scientific writing (e.g., tense usage, passive voice).
- Scientific vocabulary building (technical terms, jargon).

Writing Skills

- Structuring scientific papers: IMRAD format (Introduction, Methods, Results, and Discussion).
- Writing abstracts, introductions, methods sections, results, and discussions.

Reading and Comprehension

- Reading scientific papers effectively.
- Summarizing and critiquing scientific literature.

Presentation Skills

- Designing effective scientific posters.
- Delivering oral presentations.

Scientific Correspondence

- Writing emails and formal letters.
- Responding to reviewers and editors.

Ethics and Plagiarism

- Understanding ethical issues in scientific communication.
- Avoiding plagiarism and citing sources correctly.

Editing and Peer Review

- Techniques for self-editing and peer reviewing.
- Providing constructive feedback.

Practice Sessions and Workshops

- Writing exercises and workshops.
- Peer review simulations and practice presentations.

Advanced Topics (Optional)

- Grant writing.
- Writing for food science and technology

Study and examination requirements and forms of examination

Mixed evaluation

The final score is weighted as follows:

Written mid-term exam	50%
Practice presentations	50%
Written final exam	00%
Quiz/QCM at the end of each main chapter	00%

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	• Textbooks on scientific writing and communication. • Online resources and style guides (e.g., APA, IEEE). • Access to scientific journals for reading and analysis.

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M10. Economics and Management of a Food Company

Module Name	UET112: Economics and Management of a Food Company			
Module level	1 st year			
Code	UET112			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Lobna ESSID			
Lecturer	Lobna ESSID			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	DMPT	x		S1
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Integrated course	21 hrs	15-20 students	
	Workshop			
	PW			
Workload	Total	21 hrs	Self-study	30 hrs
Credit points	2		Coefficient	1
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Management - Economy			

Module Objectives

- Understand fundamental economic principles and their application to the food industry.
- Analyze market structures, pricing strategies, and consumer behavior specific to food products.
- Develop strategic plans tailored to the unique challenges and opportunities in the food industry.
- Implement strategies to enhance competitiveness, sustainability, and growth in food businesses.
- Interpret financial statements and utilize financial metrics to assess the financial health of food companies.
- Apply financial analysis techniques to make informed decisions regarding investments, budgeting, and cost control.
- Formulate effective marketing strategies that address consumer preferences, market trends, and competitive pressures in the food industry.
- Utilize digital marketing tools and analytics to enhance brand visibility and customer engagement.
- Optimize operational processes to ensure efficiency, quality control, and sustainability in food production and distribution.
- Effectively manage supply chain logistics to minimize costs, reduce lead times, and meet customer demands.
- Navigate and comply with regulatory requirements and standards governing food safety, labeling, and environmental sustainability.
- Promote ethical practices in food production, marketing, and corporate social responsibility initiatives.

Learning outcomes

- Apply economic and management theories to analyze the dynamics of the food

industry and optimize company operations.

- Interpret financial statements and make informed economic and financial decisions within food business contexts.
 - Analyze and optimize supply chain processes, ensuring efficiency in food production and distribution.
 - Formulate and implement strategic plans, demonstrating effective leadership and decision-making skills in managing teams within the food industry.
 - Critically evaluate the social, economic, and environmental implications of food industries to support responsible and sustainable development.
 - Develop entrepreneurial skills, applying Lean Management principles to identify inefficiencies, propose sustainable solutions, and effectively communicate business ideas across diverse audiences.
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Content

Part I: Foundation Courses:

- Introduction to Economics: Basic principles of micro and macroeconomics.
- Principles of Management: Fundamentals of management theories and practices.
- Financial Accounting: Understanding financial statements and reporting.
- Marketing Management: Strategies for marketing food products.
- Business Statistics: Analyzing data relevant to business decisions.

Part II: Core Courses:

- Food Economics: Economic principles applied to the food industry.
 - Operations Management: Managing production processes in food manufacturing.
 - Supply Chain Management: Logistics and distribution in the food industry.
 - Strategic Management: Long-term planning and competitive strategies.
 - Lean management: Integrating PDCA cycle, Kaizen method and Kanban system for effective waste reduction.
 - Managerial Accounting: Budgeting and cost analysis in food production.
 - Consumer Behavior: Understanding consumer preferences and trends in the food market.
-

Study and examination requirements and forms of examination

Mixed evaluation
The final score is weighted as follows:

Written mid-term exam	50%
Digital presentations (projects)	50%
Written final exam	00%
Quiz/QCM at the end of each main chapter	0%

Media employed

Digital presentations, Lab work manual and ISBB Extranet (<https://isbb.rnu.tn/>) for course material sharing

Reading list

- "Microeconomics" by Robert S. Pindyck and Daniel L. Rubinfeld
 - "Principles of Economics" by N. Gregory Mankiw
 - "The Economics of Food: How Feeding and Fueling the Planet Affects Food Prices" by Patrick Westhoff
 - "Food Policy in the United States: An Introduction" by Parke Wilde and Pamela A. Rhubart
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- "Strategic Management: Concepts and Cases" by Fred R. David
 - "Lean thinking" by James P. Womack and Daniel T. Jones
 - "Good Strategy Bad Strategy: The Difference and Why It Matters" by Richard Rumelt
 - "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail" by Clayton M. Christensen
 - "Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant" by W. Chan Kim and Renée Mauborgne
 - "Principles of Marketing" by Philip Kotler and Gary Armstrong
 - "Marketing Management" by Philip Kotler and Kevin Lane Keller
 - "Food Marketing" by John L. Stanton, Michael J. Etzel, and Bruce J. Walker
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M11. Bioinformatics II

Module Name	Bioinformatics II			
Module level	1 st year			
Code	UET113			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Wael TAAMALI			
Lecturer	Oussama Souii			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 h	10-15 étudiants	
	Workshop	7 h	10-15 étudiants	
	PW	0 h		
Workload	Total	28 hrs	Self-study	25 hrs
Credit points	2	Coefficient	1	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	Bioinformatics I			

Module Objectives

- Deepen knowledge in advanced bioinformatics.
- Master the use of bioinformatics tools and databases.
- Analyze and interpret complex sequencing data.
- Apply machine learning techniques in bioinformatics.
- Design and model biological interaction networks.

Learning outcomes

- Mastery of Advanced Bioinformatics Tools;
- Students will be able to use and manipulate advanced bioinformatics tools and software for sequence analysis, structural modeling, and omics data integration;
- Analysis and Interpretation of Sequencing Data;
- Students will acquire skills to analyze and interpret next-generation sequencing (NGS) data, as well as transcriptomic and epigenomic data, using appropriate bioinformatics methods;
- Applications of Machine Learning in Bioinformatics;
- Students will learn to apply machine learning and deep learning techniques to critically interpret data, solve complex problems in genomics and proteomics and to develop predictive models.
- Utilize computational tools to design and assess processing systems.
- Conduct research autonomously, critically interpreting data to draw well-supported conclusions and write scientific reports.

Content

CHAPTER I: Advanced Concepts in Bioinformatics

1. **Advanced Concepts in Molecular Biology**
2. **Advanced Definitions and Scope of Bioinformatics**
3. **Emerging Industrial Applications of Bioinformatics**

CHAPTER II: Biological Databases and Data Integration

1. **Advanced Data Management in Biological Sciences**
2. **Specialized Databases**
3. **Integrative Approaches for Data Extraction**
4. **Metagenomics and Environmental Databases**

CHAPTER III: Advanced Sequence Analysis

1. **Analysis of Next-Generation Sequencing (NGS) Data**
2. **RNA Sequencing and Transcriptome Analysis**
3. **Epigenetic Data Analysis**
4. **Comparative Genomics and Phylogenomics**

CHAPTER IV: Structural Bioinformatics

1. **Protein Structure Prediction**
2. **Protein-Ligand Docking and Virtual Screening**
3. **Molecular Dynamics Simulations**
4. **Structure-Based Drug Design**

CHAPTER V: Functional Genomics and Systems Biology

1. **Gene Ontology and Metabolic Pathways Analysis**
2. **Protein-Protein Interaction Networks**
3. **Systems Biology Approaches for Modeling**
4. **Integrative Omics: Transcriptomics, Proteomics, and Metabolomics**

CHAPTER VI: Machine Learning and Bioinformatics

1. **Introduction to Machine Learning in Bioinformatics**
2. **Applications of Deep Learning in Genomics and Proteomics**
3. **Predictive Modeling and Data Integration**
4. **Case Studies and Applications**

Practical Sessions

- **Practical 1: Advanced Literature Search (PubMed, Scopus)**
- **Practical 2: Advanced Sequence Retrieval and Analysis (NCBI, Ensembl)**
- **Practical 3: RNA-Seq Data Analysis (TopHat, Cufflinks)**
- **Practical 4: Structural Bioinformatics Tools (PyMOL, Chimera)**
- **Practical 5: Protein-Protein Interaction Analysis (STRING, Cytoscape)**
- **Practical 6: Machine Learning for Bioinformatics (SciKit-Learn, TensorFlow)**
- **Practical 7: Integrative Omics Data Analysis (MetaboAnalyst, iCluster)**

Study and examination requirements and forms of examination

Continuous assessment
The final score is weighted as follows:

Mid-term exam 1	50%
Mid-term exam 2	50%
Quiz after the end of each chapter	00%

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	▪ Jin Xiong(2006). Essential Bioinformatics. Published in the United States of America by Cambridge University Press, New York, ISBN 978-0-511-16815-4. ▪ Applied Bioinformatics An Introduction, P.M. Selzer • R.J. Marhöfer • A. Rohwer, ISBN: 978-3-540-72799-6.

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M12. Biotechnology and Genetic Improvement of Livestock

Module Name	Biotechnology and Genetic Improvement of Livestock			
Module level	1 st year			
Code	UEF211			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Slimen SELMI			
Lecturer	Moez AYADI			
	Abir MAALAWI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	MDPT	x		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	15-20 students	
	Workshop	3.5 hrs		
	PW	10.5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	40 hrs
	3		Coefficient	1.5
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
	Module UEO111 : Livestock Production (or equivalent)			
	Module UEF212 : Livestock Reproductive Technologies (or equivalent)			

Module Objectives

- Identify a factor affecting a genetic improvement in livestock
- Study the importance of the milk recording system in genetic improvement.
- Identify a different character (quantitative and qualitative)
- Study the different methods of selection program in ruminants (classic and genomic)
- Study the most common crossings systems applied in livestock
- Identify the technique of conservation and preservation of breeds
- Study the impact of artificial insemination on genetic improvement
- Study the impact of embryo transfer on genetic improvement.

Learning outcomes

- The student will be able to:
- Know the importance of milk recording system in genetic improvement
 - Distinguish between the quantitative and qualitative character
 - Applied the different methods of crossover and selection programs
 - Applied the technique of artificial insemination and embryo transfer to improve genetic performance
 - Applied the genetic evaluation of breeding animals (index of selection)
 - Evaluate and propose biotechnological strategies to enhance the utilization of low-quality raw materials in livestock production.
 - Design, execute, and document a supervised biotech-related experiment while adhering to scientific reporting standards.
 - Apply statistical tools to design experiments, analyze genetic or biotech data, and interpret outcomes for livestock improvement.

Content

-
- **CHAPTER I: Introduction**
 - Biotechnology and animal production
 - **CHAPTER II: Factor affecting a genetic improvement in livestock**
 - Environmental constraints:
 - Nutrition, season and diseases
 - Structural constraints:
 - Infrastructure, herd size, animal resources
 - **CHAPTER III: Importance of milk recording system in genetic improvement**
 - Technique of collect of data
 - Correction of data according to the factors (age, season, milk fat...)
 - **CHAPTER IV: Quantitative genetics**
 - Quantitative and qualitative character
 - Heritability and repeatability of characters
 - **CHAPTER V: Selection program in livestock**
 - Factors involved in the selection process
 - Different methods of selection
 - Genomic selection
 - Selection schema in dairy cows
 - Selection schema in ewes
 - **CHAPTER VI: Crossings program**
 - Crossing of absorption or substitution
 - Effect of crossings program in genetic improvement
 - **CHAPTER VII: Technique of animal biotechnology**
 - Artificial insemination
 - Embryo transfer (freezing)
 - Factors of variation in embryo collection
 - In vitro fertilization
 - Sexing
 - Conservation and preservation of breeds
 - **CHAPTER VIII: Impact of reproductive technologies on genetic improvement**
 - Impact of artificial insemination on genetic improvement
 - Impact of embryo transfer on genetic improvement
 - Genetic evaluation of breeding animals

Practical work:

- **PW 1:** Collection and analysis of epididymal sperm from ruminants
- **PW 2:** Genetic evaluation of dairy cattle breeders, validation of molecular differences by statistical tools
- **PW 3:** Visit to the Artificial Insemination center of the breeding, Sidi Thabet, Tunisia.

Study and examination requirements and forms of examination

Mixed evaluation
The final score is weighted as follows:

Written mid-term exam	10%
Practical works	20%
Written final exam	70%
Quiz/QCM at the end of each main chapter	0%

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing Analysis and synthesis of scientific articles on genetic improvement of livestock (group work).
Reading list	▪ Lefebvre et al. (2020). Sélection divergente sur la résistance aux mammites en races Holstein et Normande: comparaison des réponses génétique et immunitaire entre lignées ▪ Brochard et al. (2013). La sélection pour des vaches et une production laitière plus durables : acquis de la génétique et opportunités offertes par la sélection génomique. INRA Prod. Anim., 2013, 26 (2), 145-156 ▪ Introduction à l'amélioration génétique animale et exemples d'application aux élevages bovins laitiers https://planet-vie.ens.fr/thematiques/ecologie/production-agricole-agrosystemes/introduction-a-l-amelioration-genetique

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M13. Livestock Reproductive Technologies

Module Name	UEF212: Livestock Reproductive Technologies			
Module level	1 st year			
Code	UEF212			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Slimen SELMI			
Lecturer	Slimen SELMI			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	DMPT	x		S1
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21 hrs	15-20 students
	Workshop		3.5 hrs	
	PW		10.5 hrs	15-20 students
Workload	Total	35 hrs	Self-study	40 hrs
Credit points	3		Coefficient	1.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	UEF110: Physiology of milk production UEO111: Livestock production			

Module Objectives

- Understand the principles and techniques of artificial insemination (AI) and embryo transfer (ET).
- Gain proficiency in in vitro fertilization (IVF) and related reproductive technologies.
- Explore genetic manipulation and cloning in livestock reproduction.
- Learn the methods of cryopreservation for gametes and embryos.
- Develop strategies for managing reproductive health in livestock.
- Apply in vitro fertilization (IVF) methods and related reproductive technologies in a laboratory setting.
- Implement cryopreservation techniques for gametes and embryos.
- Implement marker-assisted selection to enhance breeding efficiency.
- Analyze the principles and applications of genetic manipulation and cloning in livestock.

Learning outcomes

- Demonstrate proficiency in the techniques of artificial insemination (AI) and embryo transfer (ET).
- Apply genetic selection and breeding programs to improve livestock traits.
- Explain the physiological and biochemical mechanisms of reproduction in livestock, including hormonal regulation and genetic influences.
- Develop alternative reproductive techniques for improving breeding efficiency in low-quality genetic stock.
- Demonstrate ethical responsibility, legal and ethical frameworks governing reproductive technologies in animal production.
- Design and execute a supervised reproductive technology experiment, analyzing data and presenting findings in a structured report.
- Access, evaluate and integrate information from diverse scientific sources, critically assessing emerging technologies, methods and materials for their applicability and

Content

Chapter 1: Artificial Insemination

- I. Introduction
- II. Artificial Insemination Techniques
- III. Advantages and Disadvantages of AI
- IV. Optimum Timing for AI

Chapter 2: Embryo Transfer

- I. Definition and Different Types
- II. Benefits of Embryo Transfer
- III. In-vivo Embryo Transfer
- IV. In-vitro Embryo Transfer

Chapter 3: Cloning

- I. Introduction
- II. Principle of Cloning by Nuclear Transfer
- III. Different Steps of Cloning
- IV. Different Paths of Cloning
- V. Prospects for the Use of Cloning in Breeding
- VI. Different Types of Cells Used for Somatic Cell Nuclear Transfer

Chapter 4: Transgenesis

- I. Introduction
- II. Different Types of Transgenesis
 - II-1. Random Transgenesis
 - II-2. Targeted Transgenesis
- III. Different Methods Used for the Production of Transgenic Animals

Chapter 5: Reproductive Hormones

- I. Introduction
- II. Hypothalamic-Pituitary Hormones
- III. Steroid Hormones
- IV. Other Hormones

Practical Work / Tutorial Plan

- **PW 1:** Determination of Hormonal Profile
- **PW 2:** Study of Somatic Cell Nuclear Transfer
- **Field Trip:** Visit to a Breeding Center and Monitoring of Artificial Insemination

Study and examination requirements and forms of examination

Mixed evaluation

The final score is weighted as follows:

Written mid-term exam	10%
Practical works	20%
Written final exam	70%
Quiz/QCM at the end of each main chapter	0%

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	• "Current Therapy in Large Animal Theriogenology" by R. S. Youngquist and Walter R. Threlfall • "Manual of the International Embryo Transfer Society" by International Embryo Transfer Society • "Embryo Transfer in Animals: A Practical Guide" by Allen C. Dykstra • "Principles of Cloning" by Jose Cibelli, Robert P. Lanza, Keith H.S. Campbell, and Michael D. West • "Transgenic Animal Technology: A Laboratory Handbook" by Carl A. Pinkert • "Reproductive Endocrinology and Infertility" by Peter C.K. Leung and Eli Y. Adashi • "Reproductive Hormones in Farm Animals" by Darrel Dalton and John J. Spitzer

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M14. Properties of meat products				
Module Name	Physico-chemical analysis of milk and meat products			
Module level	1 st year			
Code	UEF221			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Mourad JRIDI			
Lecturer	Mourad JRIDI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	10-20 Students	
	Workshop	3.5		
	PW	10.5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	40 hrs
Credit points	3	Coefficient		1.5
Requirements according to the examination regulations	▪ Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	▪ Physicochemical analysis techniques ▪ Structural biochemistry			

Module Objectives	- Master physico-chemical analysis techniques for milk and meat products - Understand the effect of physico-chemical parameters of milk and meat on their derivatives - Perform standardized physico-chemical tests (proximate analysis, pH, water activity, texture, colorimetry) - Correlate lab results with sensory/nutritional quality/Prepare technical reports for industry.
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Learning outcomes	- Demonstrate an understanding of the structure and function of major food components. - Describe the physical and chemical properties of foods in production and supply chains. - Demonstrate an awareness of the relationship between food, nutrition and health. - Critically analyze the properties of food matrices and be able to assess the impact of production processes on food composition and nutritional value.. - Carry out an analysis of the proximate composition of foods and of basic sensory properties, and write concise and clear scientific reports. - Design and conduct experiments using advanced laboratory techniques to evaluate food safety, quality and shelf-life, applying mathematical and statistical models to interpret results.
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Content	Chapter I: Methods of relative physicochemical analysis of milk and milk derivatives - Method of preparing a test sample for physical and chemical analysis of the milk - Milk density measurement - Method for determining titratable acidity in milk - Determining milk viscosity - Determining the freezing point of milk - Milk pH and conductivity measurement
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- Method for determining the dry matter content in milk, cream and condensed milk unsweetened
- Method for determining the total dry matter content of cheese and cheese products melted
- Method for determining protein nitrogen content in milk
- Method for determining fat content in milk gravimetric method (reference method)
- Method for determining fat content in cheese

Chapter II: Physicochemical analysis methods for meat and meat products

- Sampling and sample preparation method for meat and meat products testing meat products
- Method for determining humidity and measuring water activity (a
- pH measurement method and acidity determination
- Method for determining total phosphorus content
- Method for determining total fat content
- Method for determining total nitrogen content
- Method for determining nitrate content
- Method for determining nitrite content
- Research method and identification of anabolic substances
- Method for determining hydroxyl proline content (collagen content)
- Polyphosphate detection method
- Method for detecting coloring agents

Chapter III: Texture measurement in the food industry

- Traction
- Compression
- Simple compression
- Double compression
- Texture Profile Analysis (TPA).
- Penetrometry.
- Shear

Chapter IV: Analytical techniques in the food industry

- Moisture: Oven drying at reduced pressure
- Ash incineration - gravimetry
- Protein Kjeldahl method
- Fats Hydrolysis + extraction Petroleum ether
- Saturated, polyunsaturated and monounsaturated fatty acids NF EN ISO 12966-2 /NF EN ISO 12966-4
- Sugars (glucose + galactose, fructose, lactose, maltose, sucrose) Internal method 401SUGARS HPLC RID
- Salt + mineralization Internal method ICP

PW plan:

Practical exercise 1: Physico-chemical analysis of milk (pH, titratable acidity, TSE)

Practical exercise 2: Comparison of physicochemical properties of raw and fermented milk

PW 3: Determination of hemoglobin in red and white meat

PW 4: Meat texture analysis

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows:
	Written mid-term exam 10%
	Practical works 20%
	Written final exam 70%
	Quiz/QCM at the end of each main chapter 0%
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	▪ https://biomedguide.com/biology/biochemistry-of-food-structures-reactions-and-energy/ ▪ The science of food structuring January 2009 Soft Matter 5(3):501-510 5(3):501-510. DOI:10.1039/B718952B

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M15. Food biochemistry				
Module Name	Food biochemistry			
Module level	1 st year			
Code	UEF222			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Mourad JRIDI			
Lecturer	Mourad JRIDI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	10-20 Students	
	Workshops	3.5		
	PW	10.5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	45 hrs
Credit points	3	Coefficient	1.5	
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Physicochemical analysis techniques - Structural biochemistry			

Module Objectives	- Biomolecules of food interest: structural, nutritional and dietary aspects, application in the food industry, introduction to regulatory aspects. - Understand the effect of physico-chemical parameters of milk and meat on their derivatives
Learning outcomes	- Understand the relationship between food, nutrition and health. - Demonstrate a comprehensive understanding of the structure, function and interactions of major and minor food components, vitamins, flavours, taste and colour. - Be able to consult adequate literature and information sources and coordinate the work of experts. - Critically analyze the properties of food matrices and apply scientific and engineering principles to assess the impact of production processes on food quality, composition and nutritional value. - Formulate and solve complex problems in dairy and meat processing by applying scientific and engineering models, assessing ecological, economic and health impacts on product development. - Conduct research autonomously and extend analysis of the chemical, physical and sensory properties of foods, critically interpret data to draw well-supported conclusions and demonstrate advanced scientific knowledge base in food science and technology. - Analyze and optimize food processing systems to enhance quality, preservation, safety and sustainability of dairy and meat products.

Content	Chapter I: Macronutrients and micronutrients in foods - Water
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- Carbohydrates
- Proteins
- Lipids
- Vitamins and trace elements

Chapter II: Mechanisms of biochemical alteration of food products

- Non-enzymatic browning reaction
- Enzymatic browning reaction
- Oxidation of lipids
- Water in food
- Water activity
- Effect of aw on food spoilage

Chapter III: The functional properties of dairy proteins and their transformation during processing

- Functional properties of dairy proteins
- Effect of treatments on techno-functional properties

Chapter IV: The functional properties of meat proteins and their transformation during processing

- Functional properties of meat proteins
- Effect of treatments on techno-functional properties

Chapter V: Fermented dairy and meat products

- Fermentation (definition, reaction, types ...)
- Use of lactic acid bacteria in the food industry: yogurt, cheese, fermented sausage, ...

Practical Works:

PW 1: Rate of evolution of the Maillard reaction in milk as a function of temperature

PW 2: Indirect control of the degree of milk heating: peroxidase activity

PW 3: Separation of different food proteins by SDS-PAGE

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	10%
	Practical works	20%
	Written final exam	70%
	Quiz/QCM at the end of each main chapter	0%
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	
Reading list	▪ https://biomedguide.com/biology/biochemistry-of-food-structures-reactions-and-energy/ ▪ https://biochim-agro.univ-lille.fr/	

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M16. Food (Dairy and meat products) formulation and innovation process				
Module Name	Food (Dairy and meat products) formulation and innovation process			
Module level	1 st year			
Code	UEF231			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Ola ABDELHEDI			
Lecturer	Ola ABDELHEDI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	10-20 Students	
	Workshops	3.5		
	PW	10.5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	45 hrs
Credit points	3	Coefficient	1.5	
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Physicochemical analysis techniques - Basic food formulation - Structural biochemistry			

Module Objectives	In this course, students will learn to optimize recipes for several products, particularly meat and/or dairy products, and more specifically to formulate recipes for industrial production, considering cost and equipment constraints, as well as the desired quality. The student can explore engineering techniques for creating and improving food products. Students will learn about ingredients, formulation methods and quality standards for products' innovation. They become able to use physicochemical and sensory analysis techniques to evaluate the new product.
Learning outcomes	- Demonstrate a critical understanding of the structure/function and interactions of food components as well as the changes occurring during food process operations on the physico-chemical properties of foods. - Have developed an understanding of applicable techniques and methods and their limitations. - Apply scientific and engineering principles to solve complex problems in dairy and meat processing, assessing ecological, economic, social and health impacts on product development. - Develop innovative solutions to novel problems in dairy and meat science, balancing conflicting goals and integrating interdisciplinary knowledge. - Design and conduct experiments using advanced laboratory techniques to evaluate food safety, quality and shelf-life, applying mathematical and statistical models to interpret results. - Drawing up specifications for the development of a food product (Defines quantifiable technical characteristics: physico-chemical, organoleptic, microbiological, nutritional and cost characteristics).

- Be in continuous learning and self-improvement, critically reflecting on professional practice and staying abreast of technological advancements, emerging trends and regulatory updates in food science and technology.

Content	Chapter I: Introduction to the formulation - Innovation - Formulation strategies Chapter II: Physico-chemistry of formulation - Colloidal dispersions - Amphiphilic molecules - Polymers - Emulsions : Emulsion production processes and degradation mechanisms - Foams and defoamers Chapter III: Microencapsulation processes - Micronization/atomization - Ionotropic gelation - Coacervation - Liposomes - Microemulsion Chapter IV: Formulation of dairy and meat products - Introduction - Formulation tools : food formulation engineering - Strategies and challenges of food formulation (case studies) Chapter V: Functional foods and new products - Definitions of nutraceuticals and functional foods - Health foods - Functional foods - Nutraceuticals and their physiological activity on vital systems Workshops : - WS1: Case study : Reducing nitrates/nitrites in a processed-meat product - WS2: Case study : Reducing salt in a processed-meat product - WS 3: Case study : Reducing fat in a dairy product Practical Work: - PW 1: Visit to a meat-processing company “FARAH” - PW 2: Effect of some ingredients of the development and the quality of a dairy product										
Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table> <tr> <td>Written mid-term exam</td><td>8%</td></tr> <tr> <td>Project team-work</td><td>2%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td>Written final exam</td><td>70%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>0%</td></tr> </table>	Written mid-term exam	8%	Project team-work	2%	Practical works	20%	Written final exam	70%	Quiz/QCM at the end of each main chapter	0%
Written mid-term exam	8%										
Project team-work	2%										
Practical works	20%										
Written final exam	70%										
Quiz/QCM at the end of each main chapter	0%										
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing										
Reading list	▪ https://biomedguide.com/biology/biochemistry-of-food-structures-reactions-and-energy/ ▪ https://biochim-agro.univ-lille.fr/										

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M17. Dairy and meat products technology				
Module Name	Dairy and Meat Products Technology			
Module level	1 st year			
Code	UEF232			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Mourad JRIDI			
Lecturer	Mourad JRIDI			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	DMPT	x		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	10-20 Students	
	Workshops	3.5		
	PW	10.5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	45 hrs
Credit points	3	Coefficient	1.5	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Physicochemical analysis techniques - Basic food formulation - Milk microbiology			

Module Objectives	- Master best practices for processing milk and meat derivatives - Master key meat processing parameters
Learning outcomes	- Carry out an analysis of the proximate composition of foods and of basic sensory properties; demonstrate a comprehensive understanding of the structure, function and interactions of major and food components. - Propose solutions for the practical application of the fundamental concepts of mass, heat, and momentum transfer in food processing. - Explain the effect of processing parameters on product quality and understand the principles of process control and instrumentation. - Demonstrate a critical understanding of the changes occurring during food process operations on the physico-chemical properties of foods. - Analyze and optimize food processing systems to enhance the quality, safety and sustainability of dairy and meat products. - Access, evaluate and integrate information from diverse scientific sources, critically assessing emerging technologies, methods and materials for their applicability and impact on dairy and meat science. - Utilize advanced analytical tools to design and assess processing systems ensuring product integrity, shelf-life and compliance with regulatory standards. - Demonstrate the application of the principles of health and safety in the context of a food laboratory. - Undertake and conduct autonomously an extended analysis of the chemical, physical and sensory properties of foods, critically analyse and interpret the results by developing a capacity for self-reflection and draw well-supported conclusions related to food science and technology.

- Able to plan and carry out an experimental investigation under supervision and write a scientific report following standard conventions.

Content

Chapter I: Technologies applied to dairy products

1. Pasteurization
 - 1.1. Purpose of pasteurization, applications and effects on foodstuffs
 - 1.2. Pasteurization processes
 - 1.3. Pasteurization time and temperature
2. Sterilization
 - 2.1. Purpose of sterilization and effects on the food
 - 2.2. Sterilization processes
 - 2.3. Sterilization schedule
3. Milk evaporation and drying
 - 3.1 Evaporation
 - 3.2. Spray drying
 - 3.3. Freeze-drying
4. Cheese processing
 - 4.1. Milk preparation
 - 4.2 Coagulation
 - 4.3 Draining
 - 4.4 Salting
 - 4.5. Refining
5. Skimming
6. Homogenization

Chapter II: Technologies applied to meat products

- 1) Freezing
 - 1.1 Ice crystal formation
 - 1.2 Effect of freezing on the food
 - 1.3. Freezing processes
- 2) Defrosting
- 3) Refrigeration
 - 3.1 Meat cooling
 - 3.2 Cold storage
 - 3.3. Cooling requirements
- 4) Cooking
- 5) Dehydration
- 6) Drying technology
- 7) Salting

Chapter III: Mechanical processing of meats

- 1) Coarse chopping
- 2) Restructuring fine pasta
- 3) Consequences of chopping on products
- 4) Restructuring fine-chopped products: fine pasta: fine pasta technology
- 5) Physico-chemical characteristics of fine pastes
- 6) Fine pasta: Emulsifying, gelling and foaming power of meat proteins

Workshops:

WS 1: Study case : Process of surimi production (development and conception)

WS 2: Study case : Process of traditional cheese production (development and conception)

Practical work/Tutorial:

PW 1 : Application of two milk sterilization schedules

PW 2: Production of cheese by acid and enzymatic coagulation

PW 3: Formulating a turkey sausage

Study and examination requirements and forms of examination

Mixed evaluation
The final score is weighted as follows:

Written mid-term exam	10%
Practical works	20%
Written final exam	70%
Quiz/QCM at the end of each main chapter	0%

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	▪ https://www.mdpi.com/2304-8158/12/23/4254 ▪ https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4395031

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M18. Basic and applied parasitology

	UEO211: Basic and applied parasitology				
	1 st year				
	UEO211				
	Semester 2 (S2)				
Person responsible for the module	Slimen SELMI				
Lecturer	Hafidh AKKARI				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	DMPT			x	S2
	Type of teaching		Contact hours	Class size	
	Lecture		21 hrs	15-20 students	
	Workshops		3.5 hrs		
	PW		10.5 hrs	15-20 students	
Workload	Total		35 hrs	Self-study	40 hrs
Credit points	3		Coefficient		1.5
	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams				
Recommended prerequisites	- Microbiology - Dairy breeds health and management				

Module Objectives

- Develop an in-depth understanding of key parasitological concepts, including the biology, ecology, and life cycles of major human and animal parasites.
- Identify parasites based on their morphological and biological characteristics.
- Identify and describe the most significant parasitic diseases that pose serious public health threats globally, with a particular focus on endemic parasitoses in Tunisia.
- Understand and explain the main diagnostic techniques used in parasitology laboratories, including classical microscopy, immunological tests, and molecular methods.
- Demonstrate knowledge of prevention and control strategies for parasitic diseases, including both individual and public health prophylactic measures.

Learning outcomes

- Demonstrate knowledge of major parasitic diseases of medical, veterinary, and agricultural importance, at both global and regional levels (with a focus on Tunisia).
- Identify the main parasites affecting livestock species of zootechnical interest (ruminants, pigs, poultry), and understand their life cycles, modes of transmission, and their impact on dairy and meat productivity.
- Recognize clinical signs and parasitic lesions observed during ante-mortem or post-mortem inspections, in order to ensure the sanitary quality of meat and dairy products.
- Implement parasitological diagnostic techniques in the laboratory, including the detection of eggs, cysts, or larvae in feces, tissues, or milk,

for surveillance or sanitary certification purposes.

- Assess raw material risks and apply parasite controls in QMS.
- Develop a parasite monitoring plan and justify it in a case study.

Content

Chapter I: Introduction to Parasitology

- Definition
- Concept of the Cycle
- Types of Parasites and Parasitic Diseases
- Entry and Exit Routes
- Diagnosis, Treatment, Prophylaxis

Chapter II: Protozoan Infections

- Amoebiasis
- Flagellates of the Digestive and Urogenital Tract
- Leishmaniasis
- Trypanosomiasis
- Malaria
- Toxoplasmosis

Chapter III: Helminth Infections

- III.1- Nematodes:
 - Ascariasis
 - Enterobiasis (Pinworm Infection)
 - Toxocariasis
- III.2- Cestodes:
 - Taeniasis
 - Hydatid Cyst
 - Sparganosis
- Trematodes:
 - Schistosomiasis
 - Distomatosis (Fasciola hepatica)

Chapter IV: Giardiasis (Lambliasis)

- Definition
- Epidemiology
- Cycle
- Clinical Diagnosis
- Biological Diagnosis
- Treatment and Prophylaxis

Chapter V: Taeniasis

- Definition
- Epidemiology
- Cycle
- Clinical Diagnosis
- Biological Diagnosis
- Treatment and Prophylaxis

Chapter VI: Ascariasis

- Definition
 - Epidemiology
 - Cycle
-

- Clinical Diagnosis
- Biological Diagnosis
- Treatment and Prophylaxis

Chapter VII: Enterobiasis (Pinworm Infection)

- Definition
- Epidemiology
- Cycle
- Clinical Diagnosis
- Biological Diagnosis
- Treatment and Prophylaxis

Chapter VIII: Amoebiasis

- Definition
- Epidemiology
- Cycle
- Clinical Diagnosis
- Biological Diagnosis
- Treatment and Prophylaxis

Chapter IX: Hydatidosis

- Definition
- Epidemiology
- Cycle
- Clinical Diagnosis
- Biological Diagnosis
- Treatment and Prophylaxis

Practical Work / Tutorials Plan

- Practical Work 1: Infestation by a Sporozoite Emerging from an Oocyst
- Practical Work 2: Protozoan Parasites with Digestive Entry Point
- Practical Work 3: Bloodborne Protozoan Parasites

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	70%
	Practical works	20%
	Written final exam	00%
	Quiz/QCM at the end of each main chapter	10%

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
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Reading list	• "Parasitology: A Conceptual Approach" by William C. Campbell and Patricia A. T. Smith • "Foundations of Parasitology" by Larry Roberts and John Janovy Jr. • "Medical Parasitology: A Self-Instructional Text" by Richard M. S. M. L. Garcelon and Anthony R. H. Morris • "Protozoan Parasites of Humans" by Michael J. Doenhoff and Christine A. Roberts. • "Helminthology: An Introduction" by Peter H. Wilson • "Essential Helminthology: A Practical Guide" by L. D. Smith and S. R. C. Jackson • "Ascariasis: Biology, Pathogenesis, and Management" by H. D. Martin and R. K. Wilson • "Human Ascariidosis: A Comprehensive Review" by William C. Campbell
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M19. Hormones and their biotechnological applications

Module Name	UEO212: Hormones and their biotechnological applications			
Module level	1 st year			
Code	UEO212			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Slimen SELMI			
Lecturer	Abdelaziz SOULI			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	DMPT		x	S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	15-20 students	
	Workshops	3.5 hrs		
	PW	10.5 hrs	15-20 students	
Workload	Total	35 hrs	Self-study	40 hrs
Credit points	3	Coefficient	1.5	
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Biotechnology - Endocrinology - Biochemistry - Molecular and Biology cells - Microbiology			

Module Objectives

- Define hormones and describe their primary functions, identify and classify different types of hormones and understand their structural properties and roles in various biological systems.
- Learn the processes involved in hormone synthesis, including biochemical pathways and regulatory mechanisms. Understand how hormones are produced and controlled in the body.
- Explore the different types of hormone receptors and how they interact with hormones. Study the mechanisms of signal transduction and how hormone-receptor interactions lead to physiological responses.
- Analyze the biotechnological applications of hormones (e.g., ovulation induction, heat synchronization, growth or lactation stimulation) to improve zootechnical profitability.
- Discuss the ethical, health, and regulatory issues related to the use of hormones in animal production, particularly in the meat and dairy sectors.
- Interpret the results of experiments involving hormonal treatments (dosage levels, response curves, side effects) for purposes of control, optimization, or substitution.

Learning outcomes

- Gain knowledge about hormones , their classifications and roles
- Master the diagnostic tools used to measure hormone levels, such as ELISA and RIA. They will apply knowledge of these tools to clinical scenarios, demonstrating an ability to use hormone measurements for diagnosis and monitoring.
- Analyze ethical issues and safety concerns related to hormone use.
- Analyze the role of hormones in dairy and meat production, evaluating their impact on product quality, safety, and shelf-life.
- Apply predictive modeling techniques to assess hormone-related changes in food products, providing examples from dairy and meat processing.
- Investigate how food processing alters hormone stability and functionality in dairy/meat systems.

Content

Chapter 1. Introduction to Hormones

- Definition and Functions: What hormones are, how they work, and their roles in different organisms.
- Types of Hormones: Peptide hormones, steroid hormones, amine hormones, and their structures.

Chapter 2. Hormone Biosynthesis and Regulation

- Synthesis Pathways: How hormones are produced in the body.
- Regulatory Mechanisms: Feedback loops, signaling pathways, and receptor interactions.

Chapter 3. Hormone Receptors and Signal Transduction

- Receptor Types: G-protein coupled receptors, ion channel receptors, nuclear receptors.
- Signal Transduction Pathways: How hormone-receptor interactions lead to cellular responses.

Chapter 4. Hormones in Biotechnology

- Recombinant Hormones: Production methods, examples (e.g., insulin, growth hormone).
- Hormonal Therapies: Applications in treating diseases (e.g., thyroid disorders, diabetes).

Chapter 5. Hormone-Based Diagnostic Tools

- Diagnostic Kits: ELISA, RIA, and other assays for hormone levels.
- Clinical Applications: How these tools are used in diagnostics and patient monitoring.

Chapter 6. Hormones in Agriculture

- Growth Hormones in Livestock: Use of hormones to enhance growth and productivity.
- Plant Hormones: Application of hormones in crop growth, pest resistance, and yield improvement.

Chapter 7. Ethical and Regulatory Considerations

- Safety and Ethics: Concerns related to hormone use in medicine and agriculture.
- Regulatory Framework: Overview of guidelines and regulations governing hormone applications.

Chapter 8. Emerging Trends and Future Directions

- Innovations in Hormone Biotechnology: Advances in hormone production and applications.
- Future Research Areas: Potential developments and new applications on the horizon.

Chapter 9. Case Studies and Practical Applications

- Real-World Examples: Case studies of successful biotechnological applications of hormones.
- Hands-On Laboratory Sessions: Practical experience with hormone assays and recombinant DNA techniques.

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table> <tr> <td>Written mid-term exam 1</td><td>40%</td></tr> <tr> <td>Written mid-term exam 2</td><td>40%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td>Written final exam</td><td>00%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>0%</td></tr> </table>	Written mid-term exam 1	40%	Written mid-term exam 2	40%	Practical works	20%	Written final exam	00%	Quiz/QCM at the end of each main chapter	0%
Written mid-term exam 1	40%										
Written mid-term exam 2	40%										
Practical works	20%										
Written final exam	00%										
Quiz/QCM at the end of each main chapter	0%										
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing										
Reading list	• Hormones" by Robert K. Webster. • Biotechnology of Hormones: In Agriculture and Medicine" by Y. F. Zhao • Molecular Cell Biology" by Harvey Lodish et al. • "Principles of Biochemistry" by David L. Nelson and Michael M. Cox • Biotechnology: Academic Cell Update Edition" by David P. Clark and Nanette J. Pazdernik.										

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M20. Business English

Module Name	UET211: Business English			
Module level	1 st year			
Code	UET211			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Narimen KAMEL			
Lecturer	Narimen KAMEL			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	15-20 students	
	Workshop	0 hrs		
	PW	0 hrs		
Workload	Total	21 hrs	Self-study	30 hrs
Credit points	2	Coefficient	1	
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Basic English - Economics and Management of a Food Company			

Module Objectives

- Develop an understanding of different motivators in the workplace. Through activities and readings, students will identify key factors that influence worker motivation and apply this knowledge in writing reflective lessons.
- Analyze sales-related difficulties and challenges, particularly in international contexts. Students will explore current issues in the Chinese market, differentiate between facts and habits, and express their views on market prospects through written communication.
- Explore the concept of globalization, including its advantages and disadvantages. Students will engage in discussions, review relevant vocabulary, and develop arguments for and against globalization in their written work.
- Understand the importance of business manners, including those used in meetings and phone calls. Students will practice appropriate vocabulary and etiquette in both spoken and written business communications.
- Discuss and analyze various aspects of employment, including starting new businesses. Students will read about business startups and reflect on their own experiences through writing and speaking activities.
- Familiarize students with essential trade vocabulary and concepts. They will read about free trade and articulate their opinions on the topic through structured written arguments.
- Explore strategic planning and its importance in business. Students will analyze strategic approaches and develop an understanding of strategic decision-making processes.
- Learn about various pricing strategies and policies. Students will evaluate different pricing models and their impact on business performance.
- Master the format and content of professional business correspondence. Students will practice writing various types of business letters, focusing on clarity, professionalism, and effectiveness.

Learning outcomes

- Students will identify various motivators that affect worker performance and satisfaction. They will reflect on a positive work experience, applying this understanding to analyze and articulate personal lessons learned from the writer's experience.
- Students will evaluate common sales problems and challenges, with a focus on the Chinese market. They will distinguish between factual information and habitual trends, and compose a well-reasoned letter addressing future market prospects.
- Students will discuss and critically assess the impact of globalization, identifying both its benefits and drawbacks. They will use appropriate vocabulary to compare different aspects of globalization and present balanced arguments in their writing.
- Students will demonstrate knowledge of business etiquette in various contexts, including meetings and phone calls. They will practice using polite and professional language in both verbal and written communications.
- Students will engage in discussions about employment and business startups, and reflect on their own experiences. They will articulate their insights through both speaking and writing, showcasing their understanding of employment dynamics.
- Students will acquire and use key trade vocabulary and concepts. They will analyze the implications of free trade and express their opinions on trade issues through structured written arguments.
- Students will understand and use relevant vocabulary related to online shopping. They will apply language for recommendations and advice, and write practical tips for online shoppers, demonstrating their ability to guide consumers effectively.
- Students will understand strategic planning principles and their significance in business. They will analyze different strategic approaches and demonstrate their ability to apply strategic thinking to business scenarios.
- Students will explore various pricing strategies and their implications for business. They will evaluate pricing models and develop informed opinions on pricing policies through analysis and discussion.
- Students will master the format and structure of business letters, including the ability to write clear, professional correspondence. They will demonstrate proficiency in drafting effective business letters for various purposes.
- Students will be able to communicate scientific ideas through written, oral and visual means in English and to discuss these ideas at a high level.

Content

Chapitre I : Workers' motivation

- a- Pre-reading: a spidergram and a matching activity on the different motivators at work
- b- Reading : about a good experience at work
- c- Language review : the use of linkers and the use of the simple tense
- d- Writing : the lessons that the students learnt from the writer's experience

Chapitre II : Sales problems

- a- Starting up: gap filling with terms related to difficulties and problems in the world of business
- b- Reading: about the Chinese market today
- c- Language review : the difference between facts and habits (the use of the present perfect)
- d- Writing: a letter to the minister about the future of the Chinese market in tunisia

Chapitre III : Globalization

- a- Discuss ideas about globalization
- b- Reading : the advantages and disadvantages of globalization
- c- Language review:- words to describe entering a new market-comparing
- d- Writing: giving one's opinion about the topic using arguments (for/against)

Chapter IV: Manners in the world of business

- a- The importance of manners and the conversation of manners(meeting)

- The phone call manners
- b- Speaking and writing using the vocabulary and manners necessary in a business phone call

Chapter V :Employment

- a- Discussion
- b- Reading : Starting a new business and Writing : speaking about one's personal experience

Chapter VI : Trade

- a- Introducing students to the essential vocabulary related to trade
- b- Reading about free trade and Writing : giving one's opinion about the topic

Chapter VII : Online shopping

- a-Starting up : discussion; Vocabulary : internet terms; internet shopping
- b- Language review : modals (recommendation, necessity, obligation, suggestion and giving advice); Writing : giving tips to an online shopper

Chapter VIII : Strategy

Chapter IX : Pricing Policy

Chapter X : Business letters

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table> <tr> <td>Written mid-term exam</td><td>80%</td></tr> <tr> <td>Practical works</td><td>00%</td></tr> <tr> <td>Written final exam</td><td>00%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>20%</td></tr> </table>	Written mid-term exam	80%	Practical works	00%	Written final exam	00%	Quiz/QCM at the end of each main chapter	20%
Written mid-term exam	80%								
Practical works	00%								
Written final exam	00%								
Quiz/QCM at the end of each main chapter	20%								
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	• "Globalization and Its Discontents" by Joseph E. Stiglitz • "The Essentials of Business Etiquette: How to Greet, Eat, and Tweet Your Way to Success" by Barbara Pachter • "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" • "E-commerce 2024: Business, Technology, and Society" by Kenneth C. Laudon and Carol • "Competitive Strategy: Techniques for Analyzing Industries and Competitors" by Michael E. Porter. • "The Psychology of Price: How to Use Price to Increase Demand, Profit and Customer Satisfaction" by Leigh Caldwell								

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M 21. Professional project

Module Name	UET212: Professional project			
Module level	1 st year			
Code	UET212			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Lobna ESSID			
Lecturer	Lobna ESSID			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	DMPT	x		S2
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		28 hrs	15-35 students
	Workshops		0 hrs	
	PW		0 hrs	15-35 students
Workload	Total	28 hrs	Self-study	22 hrs
Credit points	2		Coefficient	1
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	No			

Module Objectives

- This course enables students to understand the concept of career goals and assess their skills to identify their strengths and weaknesses.
- Setting career goals to help identify areas for improvement—such as technical training—over the short and medium term to support professional advancement.
- The 'Professional Project' course serves as an educational methodology that encourages self-reflection and personal inquiry, much like the research process

Learning outcomes

- Analyze and evaluate personal competencies, achievements, and personality traits to identify strengths and areas for improvement supporting professional development.
- Critically assess and synthesize self-assessment results with external feedback to gain a holistic understanding of personal and professional competencies.
- Explore and identify career paths aligned with individual preferences and define clear, realistic career goals.
- Formulate and justify short- and medium-term professional development plans, integrating technical and interpersonal skills to align with career objectives.
- Demonstrate effective communication with multidisciplinary teams in national and international context, conveying complex scientific information in a clear, concise and professional manner.
- Design a comprehensive professional project incorporating self-awareness, labor market research, and strategic planning to enhance employability and career success in the food industry.
- Engage in continuous learning and self-improvement, critically reflecting on professional practice.
- Demonstrate ethical responsibility, integrity and adherence to professional standards in food science, maintaining respect for regulatory frameworks in dairy and meat industries.

Content	Chapter 1: Understanding Personal Identity • Introduction to the DOTS Model (Decision learning, Opportunity awareness, Transition learning, and Self-awareness) • Exploring personality traits and their connection to professional achievements • Identifying personal values and preferences • Preparing a personal portfolio for job interviews Chapter 2: Exploring Opportunities, Careers, and Networks • Developing opportunity awareness • Self-assessment of job search skills and career readiness • Analyzing future job trends and emerging career paths Chapter 3: Navigating the Transition to Professional Life • Defining clear and achievable career goals • Creating an effective CV and cover letter • Preparing for interviews • Workshop: Simulated job interview and feedback session										
Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table> <tr> <td>Written mid-term exam</td><td>50%</td></tr> <tr> <td>Practical works</td><td>00%</td></tr> <tr> <td>Teamwork project</td><td>50%</td></tr> <tr> <td>Written final exam</td><td>00%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>00%</td></tr> </table>	Written mid-term exam	50%	Practical works	00%	Teamwork project	50%	Written final exam	00%	Quiz/QCM at the end of each main chapter	00%
Written mid-term exam	50%										
Practical works	00%										
Teamwork project	50%										
Written final exam	00%										
Quiz/QCM at the end of each main chapter	00%										
Media employed	Digital presentations and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing										
Reading list	• Designing Your Work Life" by Bill Burnett and Dave Evans • Pivot: The Only Move That Matters Is Your Next One by Jenny Blake										

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M 22. Bioethics and Biosecurity II				
Module Name	Bioethics and biosecurity II			
Module level	1 st year			
Code	UET211			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	ZAIED CHIRAZ			
Lecturer	ZAIED CHIRAZ			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop			
	PW			
Workload	Total	21 hrs	Self-study	30 hrs
Credit points	2	Coefficient	1	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites				

Module Objectives	- Develop critical reflection on the ethical implications of scientific research and medical practices - Guarantee dignity and respect for fundamental human rights with regard to applications of biology and medicine - Concerning biosecurity, know the practical technologies linked to containment implemented to prevent involuntary exposure to pathogenic organisms or their accidental release into the environment.
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Learning outcomes	The students will be able to: - Analyze and evaluate the fundamental principles of bioethics and their ethical implications across various areas of application. - Critically examine the laws and ethical frameworks governing bioethics in different contexts to assess their societal and legal impacts. - Demonstrate ethical responsibility, integrity and adherence to professional standards in food science, maintaining respect for regulatory frameworks in food industries. - Formulate reasoned arguments on controversial bioethical issues and demonstrate the ability to communicate complex bioethical dilemmas effectively. - Understand core concepts of biosecurity, including biological risk classification (microbiological, chemical and biochemical risks) and the principles of risk
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management, in laboratory context.

- Evaluate the impact of biosecurity practices on public health and safety, and recommend improvements to current systems.
- Possess comprehensive knowledge of legal and regulatory requirements, quality standards and good practices applicable to dairy and meat industries.
- Implement principles of hygiene, cleaning and sanitation within dairy and meat processing environments, understanding their role in quality assurance, waste management and regulatory compliance.
- Evaluate the social, economic and environmental implications of dairy and meat processing practices and proposing sustainable alternatives

Content	• CHAPTER I: BIOETHICS • Bioethics • The fundamental principles of bioethics • Areas of application: • Reproductive and therapeutic cloning • Use of human embryos • Prenatal diagnosis • Medically assisted procreation (AMP) • Organ donation • Embryonic stem cells • The laws of bioethics • The issues of bioethics • CHAPTER II: BIOSECURITY • Biosecurity • The basics of biosecurity • The objective concept of risk class • Biological risk assessment • Risk management
Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: • Written exam: 140% • Written exam 2: 40% • Oral presentation : 20%
Media employed	The essential course materials are available on the site; https://isbb.rnu.tn
Reading list	1- UNESCO, 2006, Universal Declaration on Bioethics and Human Rights, Paris, UNESCO. 2- UNESCO, Basic course in bioethics, 2008, Paris, Éditions Unesco.

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M23. Cheese- and butter-making technologies				
Module Name	Cheese- and butter-making technologies			
Module level	2 nd year			
Code	UEF311			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Mourad JRIDI			
Lecturer	Mourad JRIDI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	10-20 Students	
	Workshops	3.5		
	PW	10.5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	45 hrs
Credit points	3	Coefficient	1.5	
Requirements according to the examination regulations	▪ Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	▪ Physicochemical analysis techniques ▪ Basic food formulation ▪ Food biochemistry ▪ Dairy and Meat Product Technology			

Module Objectives	- Mastering cheese-making technology - Mastering butter-making technology - Identify and analyze common defects in cheese and butter production, such as coagulation failures, texture defects, and swelling problems, and propose corrective actions.
Learning outcomes	- Demonstrate advanced knowledge and critical understanding of biochemical principles relevant to dairy science and the changes occurring during process operations on the physico-chemical properties of dairy products. - Explain and apply the main steps in cheese and butter production, including milk preparation, coagulation, draining, ripening, and continuous butter-making processes. - Identify and analyze defects in cheese and butter production and solve these processing problems by applying scientific and engineering models. - Develop solutions to optimize dairy processing operations and improve product quality in response to observed production accidents or defects, in order to enhance the quality, safety and sustainability of dairy products. - Critically evaluate the influence of factors such as food matrix quality (mastitis milk), heat treatment, inhibitors and chilling on the quality (e. g. composition and sensory) and safety of butter and cheese, analyse and interpret the results. - Perform practical production and physico-chemical analysis of butter and pressed cheese following industry standards. - Conduct experiments using advanced laboratory techniques to evaluate food safety, quality and shelf-life, under supervision and write a scientific report following standard conventions.

Content	Chapter I General information on cheese-making technology Section I: Preparation of cheese milk Section II: Coagulation Section III: Coagulum draining and cheese ripening Chapter II General information on butter-making technology Section I: continuous butter production Section II: Control parameters Section III: sweet or sour butter Chapter III Production accidents and defects - Coagulation and draining defects - Inhibition factors and stimulants in raw milk - Natural inhibiting factors in raw milk - Influence of stimulants and heat treatment on the growth of lactic acid bacteria - Exogenous factors - Factors affecting coagulation and drainage - Mastitis milks - Chilled milks - Refining defects - Texture and swelling defects - Dry paste - Pourable dough - Unopened cheese - Waxed cheese - Cheese too open - Early swelling - Late swellings or butyric swellings - Appearance and crusting defects - Blue" accidents Practical work : Practical work at the agri-food sector center in City El Khadhra (Hall technologique) PW1: Butter production and physico-chemical analysis PW2: Pressed cheese production and physico-chemical analysis								
Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table border="1"> <tbody> <tr> <td>Written mid-term exam</td><td>8%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td>Written final exam</td><td>70%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>2%</td></tr> </tbody> </table>	Written mid-term exam	8%	Practical works	20%	Written final exam	70%	Quiz/QCM at the end of each main chapter	2%
Written mid-term exam	8%								
Practical works	20%								
Written final exam	70%								
Quiz/QCM at the end of each main chapter	2%								
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	▪ https://www.fao.org/4/T0045E/T0045E04.htm ▪ https://books.lib.uoguelph.ca/dairyscienceandtechnologyebook/chapter/butter-manufacture/								

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M24. Artisanal and Industrial Technologies for Fermented Dairy Products

Module Name	Artisanal and Industrial Technologies for Fermented Dairy Products			
Module level	2 nd year			
Code	UEF312			
Semester(s) in which the module is taught	Semester 1 (S3)			
Person responsible for the module	Sana M'HIR			
Lecturer	Sana M'HIR			
	Ali salem			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	15-25 students	
	Workshop	3,5 hrs	15-25 students	
	PW	10,5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	40 hrs
Credit points	3	Coefficient	1,5	
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours > 20 % of nonattendance = elimination for exams			
Recommended prerequisites	Module ECU F121: Milk microbiology			

Module Objectives

- Recognizing the role of the milk's constituents;
- Analyse the importance of unit operations in a dairy industry
- Identify and analyse diagrams, starter in the manufacture artisanal dairy products in Tunisia and around the world;
- Understand the role of fermentation in the production of fermented dairy products;
- Understand the production flow diagrams of various artisanal fermented products;
- critically evaluate the role of ferments in the manufacture of these products.
 - promote indigenous ferments in traditional lactic fermented products

Learning outcomes

- Critical understanding of microbiological principles relevant to fermented dairy products
- Critically analyze the properties of food matrices (the components of milk) to assess the impact of production processes on food quality related to fermented dairy products (technological and functional characteristics);
- Analyze and optimize food processing systems (role of unit operations) to enhance the quality, safety and sustainability of fermented dairy products;
- Evaluate the key steps involved in making yogurt and fermented milk; and cheese (traditional);
- Master the flowchart for making artisanal dairy products with traditional and industrial methods;
- Analyze and optimize processing systems to enhance the quality, safety and sustainability of fermented food products;
- Critically evaluated the potential of starter culture;
- Perform practical production of artisanal dairy product:
- Conduct research autonomously, critically interpreting data to draw well-supported conclusions and advancing the scientific knowledge base in food science and technology and write scientific reports.

CHAPTER I: Introduction to fermentation and the development of fermented products

CHAPTER II: Milk and role of constituents/Milk processing

- Role of proteins (caseins and serum proteins): techno-functional properties, adaptation of the protein level depending on the texture.
- Features of fat: Influence of this complex raw material, study its characteristics to make a fermented milk product
- Milk processing: Pasteurization, Homogenization and Standardization

CHAPTER III: Lactic fermentation

- Introduction to fermented milks
- Lactic metabolism
- Traditional microflora, mesophilic and thermophilic ferments

CHAPTER IV: Yogurt

- Stages, roles and microbiology of fermentation, cooperation of ferments, manufacturing diagram, characteristics, additives, main defects and their possible causes.
- Other traditional products with a consistency close to yogurt: Zabady, Dahi, Amassi, Bulgarian buttermilk, etc.

CHAPTER V: Artisanal fermented dairy products in Tunisia.

- Lben and Rayeb: microflora, manufacturing diagram, comparison with industrial products, types of selected ferments.
- “crème fraîche”: diagram and microflora

CHAPTER VI: Other artisanal fermented dairy products around the world.

- Kefir, koumiss, Ayran, Viili, Amasi, Skyr...
- Microflora, manufacturing diagram, comparison with industrial products
- Foods based on mixed: fermented milk cereals: kishk, Tarhana and traditional probiotic products.

CHAPTER VII: Artisanal cheese

- Definition
- Starters

Practical work:

- **PW 1:** Effets des ferments lactiques sur l'acidification du lben
- **PW 2:** Production of yogurt: The agri-food sector center in Cité El Khadhra (dairy hall)
- **PW 3:** Effect of starters concentrations on kefir quality
- **PW 4:** On site visit to the agricultural and food industries

Workshops:

Article analysis related to

- **Workshop 1:** Appropriate starter culture technologies for small-scale fermentation in developing countries.
 - **Workshop 2:** A comparison of the physicochemical, microbiological and aromatic composition of Traditional and Industrial Leben in Tunisia.
 - **Workshop 3:** Dynamic evaluation of the nutritional composition of homemade koumiss from Inner Mongolia during the fermentation process
 - **Workshop 4:** Physicochemical and microbiological evaluation of artisanal cheeses during maturation.
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Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table> <tr> <td>Written mid-term exam</td><td>6%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td>Written final exam</td><td>70%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>0%</td></tr> <tr> <td>Workshops</td><td></td></tr> <tr> <td>Flipped classroom teaching method</td><td>4%</td></tr> </table>	Written mid-term exam	6%	Practical works	20%	Written final exam	70%	Quiz/QCM at the end of each main chapter	0%	Workshops		Flipped classroom teaching method	4%
Written mid-term exam	6%												
Practical works	20%												
Written final exam	70%												
Quiz/QCM at the end of each main chapter	0%												
Workshops													
Flipped classroom teaching method	4%												
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing												
Reading list	• Fundamental food microbiology, CRC press, ISBN 0-8493-1610-3 • Techniques de l'ingénieur : Fabrication des produits alimentaires par fermentation, F3500 • Sciences et Technologies du lait, Transformation du lait, Carole L. Vignola ISBN 2-553-01029-X • Chapter 1: Traditional Foods, Case Studies in the Traditional Food Sector, Elsevier 2018, http://dx.doi.org/10.1016/B978-0-08-101007-5.00002-6 • Encyclopedia of Dairy Sciences, Patrik F.Fox and Paul L.H. McSweeney, 2011, Elsevier. ISBN:978-0-12-374402-9												

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M25. Properties of meat products

Module Name	Properties of meat products			
Module level	2 nd year			
Code	UEF321			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Mourad JRIDI			
Lecturer	Ali SALEM			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	DMPT	x		S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	10-20 étudiants	
	Workshops	3.5		
	PW	10.5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	40 hrs
Credit points	3	Coefficient	1.5	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Safety and toxicology of meat products (or equivalent) - Physico-chemical analysis of meat products (or equivalent)			

Module Objectives

- Examine the most important qualities of meat
- Understanding the processes used to obtain meat that consumers will find appetizing and palatable.
- Examining the various organoleptic properties of meat.
- Analyzing the chemistry and structure of the meat; highlighting the significance of distinguishing between fresh and aged meat.

Learning outcomes

The students will be able to:

- Describe muscle structure, classification, categories, and quality criteria of different meats, including their nutritional, health, organoleptic, and technological qualities;
- Explain the technical aspects of meat, such as the conversion of muscle into meat, freezing processes, and factors affecting sanitary quality;
- Analyze the structure and tenderness of meat, including the roles of collagen, fat, maturation and cooking effects;
- Evaluate water holding capacity in meat products, understanding its chemical basis, measurement, and impact on microbial growth and technological properties;
- Demonstrate advanced knowledge and critical understanding of biochemical principles relevant to meat science, including spoilage organisms, toxins and preservation methods;
- Critically analyze the properties of meat matrix (explain the intrinsic and extrinsic causes) and apply scientific and engineering principles to assess the impact of production processes and matrix quality on food composition, shelf-life and nutritional value;
- Apply practical skills through company visits, experiments, and mini-projects to assess meat quality, tenderness, charcuterie technology, and organoleptic properties;

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- Solve complex problems in meat processing by applying scientific and engineering models and develop the capacity of self-reflection;
 - Design and conduct experiments using advanced laboratory techniques to assess physical properties of meat products and to evaluate food safety, quality and shelf-life, ensuring rigorous data collection, analysis, interpretation and writing scientific reports.
-

Content

Chapter I : Generality

- The quality of the meat
- Muscular structure
- Classification of meats
- Categories
- Tractability
- Storage and preservation

Chapter II : Meat

- Meat from a technical perspective
- Lean meat (converting muscle into meat)
- Freezing of meat
- Sanitary quality

Chapter III : Quality criteria for meat

- Nutritional quality
- Health Quality: Toxicology and pathology
- Organoleptic quality
- Technological quality processing

Chapter IV : Structure and tenderness of meat

- The role of collagen
- The role of fat
- Maturation
- Effect of cooking on tenderness of meat

Chapter V: Meat products

- Beef
- Poultry
- Charcuterie technology

Chapter VI: Evolution of the water holding capacity

- Chemical composition of muscle
- Muscle water: definition
- Muscular water: application
- Water activity
- Relationship between aw and microorganisms
- The capacity of water retention
- Organoleptic qualities and technological skills

Practical work

- Practical Work 1: Study visit to El Mazraa company (Day 1)
- Practical Work 1: Study of the cooking effect on the tenderness of meat

Guidance Work

- Guidance work 1 : Mini-project on meat quality criteria
 - Guidance work 2 : Mini-project on charcuterie products
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- Guidance work 3: Mini-project on meat water holding capacity
- Guidance work 4: Mini-project on the organoleptic properties of meat

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	5%
	Practical works	20%
	Written final exam	70%
	Team-work projects	5%

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
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Reading list	▪ http://dspace.univ-tiaret.dz/bitstream/123456789/6446/1/TH.DVET.FR.2019.44.pdf ▪ Zhao, X., Chen, L., Wongmaneepratip, W., He, Y., Zhao, L., & Yang, H. (2021). Effect of vacuum impregnated fish gelatin and grape seed extract on moisture state, microbiota composition, and quality of chilled seabass fillets. Food Chemistry, 354, 129581. ▪ https://www.univ-chlef.dz/fsnv/wp-content/uploads/Cours-M2-contr%C3%B4le.pdf
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M26. Processing of meat products

Module Name	Processing of meat products			
Module level	2 nd year			
Code	UEF322			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Mourad JRIDI			
Lecturer	Ali SALEM			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	DMPT	x		S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	10-20 étudiants	
	Workshop	3.5		
	PW	10.5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	45 hrs
Credit points	3	Coefficient	1.5	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours > 20 % of nonattendance = elimination for exams			
Recommended prerequisites	Physico-chemical analysis of meat products (or equivalent)			

Module Objectives

- Study of the biochemical and organoleptic transformation of meat and meat products.
- Optimization of the different parameters affecting the meat quality.
- Study of the various ingredients and additives role in the meat products processing
- Gain greater Knowledge into optimizing the quality of meat products and designing new products.

Learning outcomes

- Demonstrate an understanding of the diversity, classifications, and development stages of meat products;
- Apply and analyse the changes in meat during processing operations and preserving methods (e.g. cooling techniques) and their effect on the physico-chemical properties of the products;
- Use advanced methods of scientific investigation to research chemical and physical properties of meat products, ensuring rigorous data collection, analysis and interpretation.
- Evaluate the different roles of ingredients and additives, and investigate the importance of optimizing formulations for processed meat products;
- Analyze and apply key manufacturing operations in meat processing through practical work and case studies linking theory to industrial practices;
- Undertake an extended analysis of the chemical, physical and sensory properties of meat products, critically analyse and interpret the results;
- Understand the principles of food processing control and propose solutions for the practical application of the fundamental concepts; be in continuous learning and self-improvement, and stay abreast of technological advancements, emerging trends and regulatory updates in food science and technology.
- Apply scientific and engineering models, to assess ecological and health impacts of product development to solve problems in meat processing;
- Design and conduct experiments using advanced laboratory techniques to evaluate food safety, quality and shelf-life,

- Analyze and optimize food processing systems to enhance the quality, safety and sustainability of dairy and meat products.

Content

Chapter I : Meat products diversity

- Introduction: Links in the meat industry and meat processing
- Section I: Definition and Stages of Meat Product Development
- Section II: Classification and Examples of Meat Products
- Section III: The value of diversity in meat products

Chapter II : Meat product base material

- Introduction: Main animal-derived raw materials and their states
- Section I: Tissue Concepts: Muscle Tissue, Connective Tissue (Collagen Example: Properties and Transformations), Adipose Tissue.
- Section II: Animal Tissue Quality: Muscle Technological Quality (Post-mortem Transformations, Meat Defects), Adipose Tissue Technological Quality.
- Section III: Primary Markets for Normal and Defective Meats

Chapter III : Ingredients et additives

- Introduction: importance of optimizing the formulation of meat products
- Section I: Definition and differences between ingredients and additives
- Section II: Classes of Ingredients and Additives
- Section III: Roles of different classes of ingredients and additives in meat processing

Chapter IV : Manufacturing operations

- Introduction: The production flow of various classes of meat products
- Section I: Raw Material Controls on Delivery, Cutting and Boning, Raw Material Preparation, and Dough Preparation.
- Section II: Roles of different unit operations in biochemical and organoleptic transformation of meat matter
- Section III: Case Study: Sausage Manufacturing
- Types of sausages: formulation, manufacturing diagram, factors affecting
- Organoleptic qualities, Artisanal process comparison

Practical work

- Practical Work 1: Study visit to El Mazraa company (Day 2)
- Practical Work 2: Determination of the different parameters during meat conservation

Workshops

- Workshop 1 : Mini-project on the various kinds of meat products available in Tunisia
- Workshop 2 : Mini-projects on the methods applied to preserve the transformed meat products
- Workshop 3: Mini-projects on the formulation of meat products.

Study and examination requirements and forms of examination

Mixed evaluation
The final score is weighted as follows:

Written mid-term exam	5%
Practical works	20%
Written final exam	70%
Team-work projects	5%

Media employed

Digital presentations, Lab work manual and ISBB Extranet (<https://isbb.rnu.tn/>) for course material sharing

Reading list

- <http://dspace.univtiaret.dz/bitstream/123456789/6446/1/TH.DVET.FR.2019.44.pdf>
 - Zhao, X., Chen, L., Wongmaneepratip, W., He, Y., Zhao, L., & Yang, H. (2021). Effect of vacuum impregnated fish gelatin and grape seed extract on moisture state, microbiota composition, and quality of chilled seabass fillets. *Food Chemistry*, 354, 129581.
 - <https://www.univ-chlef.dz/fsnv/wp-content/uploads/Cours-M2-contr%C3%B4le.pdf>
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M27. Nutritional value of milk and meat products

Module Name	UEF331: Nutritional value of milk and meat products			
Module level	2 nd year			
Code	UEF331			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Slimen SELMI			
Lecturer	Abdelaziz SOULI			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	DMPT	x		S3
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21 hrs	15-20 students
	Workshop		3.5 hrs	
	PW		10.5 hrs	15-20 students
Workload	Total	35 hrs	Self-study	40 hrs
Credit points	3		Coefficient	1.5
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	Nutrition			

Module Objectives

- Explore and critically analyze the role of milk and its derivatives in human nutrition, including the nutritional value, production processes, and potential health impacts of cow's milk and human milk.
- Understand lactose intolerance and milk sensitivity, including the biochemical nature of lactose, symptoms, and management strategies, as well as how yogurt can aid in lactose digestion.
- Assess the nutritional contributions of dairy products to adult diets and their therapeutic uses, particularly in managing digestive infections and malnutrition.
- Examine the nutritional benefits and potential risks associated with meat consumption, including the types of meat, their nutrient profiles, and guidelines for healthy consumption.
- Analyze the impact of meat consumption on human health, focusing on its benefits and risks, and its association with various diseases such as obesity, diabetes, cardiovascular diseases, and cancer.
- Apply theoretical knowledge through practical experiments and presentations, including the analysis of milk components, measurement of iron in beef, and presenting findings on the nutritional benefits and impacts of dairy products and meats.

Learning outcomes

- Understand the nutritional roles of milk, dairy products, and meat in human diets, including their contributions to health and development.
- Describe lactose intolerance, its definition, symptoms, and the genetic and environmental factors influencing its prevalence.
- Evaluate the nutritional benefits of dairy products, including their therapeutic uses in treating malnutrition and digestive infections.
- Analyze global consumption patterns of milk and dairy products, and their cultural and dietary significance.

- Assess the health impacts of meat consumption, including its nutritional benefits and potential risks related to chronic diseases.
- Critically analyze the properties of food matrices to assess the impact of production processes on food quality and nutritional value.
- Demonstrate an awareness of the relationship between food, nutrition and health.
- Able to plan and carry out an experimental investigation under supervision and write a scientific report following standard conventions.
- Develop innovative solutions to c novel problems in dairy and meat science, balancing conflicting goals and integrating interdisciplinary knowledge.

Content

Chapter I: Consumption of Milk and Its Derivatives

A/ Introduction

B/ Cow's Milk (A food for calves, Dairy production, Harmful effects of milk, Pathological evolution, Why say no to cow's milk)

C/ Human Milk (Breastfeeding, Milk adapted for newborns, Breast milk: multiple functions)

Chapter II: Milk Sensitivity and Lactose Intolerance

1/ Lactose

2/ What is lactose intolerance?

3/ Which dairy products contain lactose?

4/ What to do in the absence of lactase?

5/ Yogurt helps in lactose digestion (Yogurt, Lactose intolerance, Varied textures, Composition, Nutritional value and benefits)

Chapter III: Nutritional Importance of Dairy Products in Humans

A/ Introduction

B/ Nutritional importance of dairy products in adults

C/ Consumption possibilities for the sick (Importance of yogurt and fermented milk during digestive infections, Use of milk in severe malnutrition situations, Milk and yogurt in diets)

Chapter IV: Nutritional Benefits of Meats and Meat Products

1/ Definition

2/ What are the nutritional benefits?

3/ What are the risks?

4/ How much meat to consume

5/ Types of meat

Chapter V: Nutritional Quality of Meats and Their Effects on Human Health

A/ Introduction

B/ Meat: A health food for humans

C/ Meat and the risk of certain diseases

Definition

Meat and obesity

Meat and diabetes (Pathophysiology, Role of meat and charcuterie)

Meat and cardiovascular diseases

Meat and cancer (Pathophysiology: accepted data, Colorectal cancer)

General Conclusion

Practical Work / Workshops

- Practical Work 1: Milk and its components (Identification of the main components of milk)
- Practical Work 2: Iron content measurement in beef
- Practical Work 3: Oral presentations on dairy products and meats, nutritional benefits and their impact on human health.

Study and examination requirements and forms of examination

Mixed evaluation

The final score is weighted as follows:

Written mid-term exam	10%
Practical works	20%
Written final exam	70%

Quiz/QCM at the end of each 00%
main chapter

Media employed

Digital presentations, Lab work manual and ISBB Extranet (<https://isbb.rnu.tn/>)
for course material sharing

Reading list

- "Dairy Chemistry and Biochemistry" by P.F. Fox and P.L.H. McSweeney
 - "The Science and Fine Art of Food and Nutrition" by Arnold Ehret.
 - "Milk and Milk Products: Technology, Chemistry, and Microbiology" edited by H. S. S. Sharma and R. A. J. Cato.
 - "Lactose Intolerance: A Comprehensive Guide" by Robert A. Wood
 - "Meat Consumption and Health: The Evidence" edited by A. E. Willett and D. A. Schaefer.
 - "The Meat Paradox: Understanding the Health Risks and Benefits" by S. M. de Silva
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M28. Safety and toxicology of dairy and meat products

Module Name	Safety and toxicology of dairy and meat products			
Module level	2 nd year			
Code	UEF332			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Bensassi Fatma			
Lecturer	Bensassi Fatma			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	DMPT	x		S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop			
	PW	14 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	40 hrs
Credit points	4	Coefficient	2	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Food biochemistry - Microbiology - Cell biology (or equivalent)			

Module Objectives

- Identify toxicants for dairy and meat products
- Understand mechanisms of action of toxicants.
- Master toxicokinetics: absorption, metabolism and elimination
- Use *in vivo* experimentation and *in vitro* methods in compliance with regulatory requirements and bioethics.
- Evaluate the severity of the toxic effect in relation to the dose.
- Determine the toxicant dose in dairy or meat products.
- Apply appropriate techniques to assess and manage human risks.

Learning outcomes

The student will be able to:

- Understand toxicology based on different sources of contamination and demonstrate advanced knowledge and critical understanding of microbiological principles relevant to dairy and meat science, including pathogenic organisms toxins and preservation methods.
- Demonstrate knowledge on the consequences of dairy and meat products contamination by toxic substances on health and how to intervene to avoid or reduce toxicity
- Possess comprehensive knowledge of regulatory requirements, quality standards and good practices applicable to dairy and meat industries, ensuring consumer safety.
- Design and conduct experiments using advanced laboratory techniques to evaluate food safety, quality and interpret results.
- Implement principles of hygiene, cleaning and sanitation within dairy and meat processing environments, understanding their role in quality assurance and consumer safety.

Content

Chapter 1: Definitions and general concepts in toxicology
1. Evolution of a toxic effect

-
2. Routes of exposure
 3. Classification of toxicants
 4. Dose/response and dose/effect relationships
 5. Forms of poisoning

Chapter 2: Toxicokinetics

1. Entry of a toxicant
2. Transportation and distribution
3. Biotransformation
4. Excretion

Chapter 3. Mechanisms of action of toxicants

- Cytotoxicity
- Genotoxicity
- Cellular death

Chapter 4. Contaminants in dairy and meat products

- Different types of toxicants
- Routes of contaminations
- Toxicants detection methods

Chapter 5. Basics of food security

- Definitions
- Evaluation of food security

Workshops

- WS1: Research paper analysis
- WS2: presentation of food toxicology

Practical work

- PW1: On site visit to toxicology units in industrial laboratories
- PW2: Detection and quantification of xenobiotics in milk

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	10%
	Practical works	20%
	Written final exam	70%
	Quiz/QCM at the end of each main chapter	00%

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
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Reading list	- Guide pratique de toxicologie: Pour les professionnels de l'industrie, la santé et l'environnement. Franz Xaver Reichl 2010. (3ème édition traduite par Robert Perraud). Editeur DE BOECK SUP.
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- Toxicologie de Xavier Coumoul et al.2017. Editeur DUNOD

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M29. Packaging and conditioning of dairy and meat products				
Module Name	Packaging and conditioning of dairy and meat products			
Module level	2 nd year			
Code	UEO311			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Ola Abdelhedi			
Lecturer	Ola Abdelhedi			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT		x	S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	10-20 Students	
	Workshops	3.5		
	PW	10.5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	17 hrs
Credit points	3	Coefficient	1.5	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Conservation, conditioning and packaging techniques - Food biochemistry - Food (Dairy and meat products) formulation and innovation process			

Module Objectives

- Learn the properties of packaging materials, roles, advantages and limitations.
- Be able to choose a packaging material and technique according to the product.
- Packaging for dairy and meat products : Study container/content interactions.
- Be able to carry out packaging controls and analysis.
- Study the emerging technologies in dairy and meat packaging materials.
- Know the regulations related to emerging food packaging.

Learning outcomes

- Have a deep knowledge on the principles and limitations of food preservation and packaging in maintaining food quality and safety.
- Apply appropriate judgement to select suitable preservation and packaging methods for different food products.
- Demonstrate understanding of the characteristics and properties of packaging materials to choose appropriate systems for specific food applications.
- Analyze food-packaging interactions, including migration risks and regulatory requirements to ensure consumer safety and product compliance.
- Evaluate and apply emerging packaging technologies (active, smart, edible, biodegradable) and perform practical tests to determine material suitability for food packaging.
- Possess comprehensive knowledge of regulatory requirements applicable to dairy and meat packaging ensuring compliance and consumer safety.
- Formulate and solve problems in dairy and meat packaging by applying scientific and engineering models, assessing ecological, economic, social and health impacts on product development.
- Design and conduct experiments on packaging using advanced laboratory techniques to evaluate food safety, quality and shelf-life.

- Access, evaluate and integrate information from diverse scientific sources, critically assessing emerging technologies, methods and materials for their applicability to food packaging.
- Utilize advanced analytical tools to assess packaging systems, ensuring product integrity, shelf-life and compliance with regulatory standards.

Content	Chapter I: Packaging and fundamentals of materials science - Definition - Role of food packaging - Materials' resistance Chapter II: The preservation functions of food packaging - Shelf-life of foods concept - Preserving food quality - Preventing microbiological alteration risk - Preventing physico-chemical alteration risk Chapter III: Interaction and communication with the consumer - The information function - Marketing functions Chapter IV: Packaging materials - Glass packaging - Metal Packaging - Paper and cardboard packaging - Plastic packaging - Biosourced and biodegradable polymers-based packaging Chapter V: Emerging food packaging technologies - Vacuum (low-oxygen) atmosphere packaging - Modified atmosphere packaging - Aseptic packaging - Frozen food packaging Chapter VI: Food/packaging interactions - Food contact material regulations - Overall and specific migration testing - Migrants' diffusion kinetics Chapter VII: Intelligent and active packaging - Packaging innovations - Emerging needs and legislative issues - Active packaging : absorbing and releasing systems - Smart packaging - Edible packaging Practical work ● PW1 : Study different types of packaging: visit to the SICAM company - Daily'n company ● PW2 : Synthesis and characterization of packaging films from different biopolymers Workshops ● WS 1: Determine the properties of packaging materials (mechanical, permeability, thermal properties ...) ● WS 2 : Study the diffusion kinetics of migrants ● WS 3: Analyze scientific papers										
Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table> <tr> <td>Written mid-term exam 1</td><td>40%</td></tr> <tr> <td>Team-work project</td><td>20%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td>Written mid-term exam 2</td><td>20%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>0%</td></tr> </table>	Written mid-term exam 1	40%	Team-work project	20%	Practical works	20%	Written mid-term exam 2	20%	Quiz/QCM at the end of each main chapter	0%
Written mid-term exam 1	40%										
Team-work project	20%										
Practical works	20%										
Written mid-term exam 2	20%										
Quiz/QCM at the end of each main chapter	0%										
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing										

Reading list

- SCIENCE DES ALIMENTS, Volume 2 : Technologie des produits alimentaires (Biochimie • Microbiologie • Procédés • Produits). Lavoisier 2007, ISBN 2-7430-0888-8
 - SCIENCE DES ALIMENTS, Volume 1 : Stabilisation biologique et physico-chimique (Biochimie • Microbiologie • Procédés • Produits). Lavoisier 2006, ISBN 2-7430-0833-4
 - <https://www.sciencedirect.com/science/article/abs/pii/S2214785322052300>
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M30. Valorisation of by-products from milk and meat processing

Module Name	Valorisation of by-products from milk and meat processing			
Module level	2 nd year			
Code	UEO312			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Wisseem Bhouri			
Lecturer	Wisseem Bhouri			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT		x	S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	3.5 hrs		
	PW	10.5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	17 hrs
Credit points	4		Coefficient	2
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites				

- Environmental issues and impacts, reminders
- Storage and processing
- The different ways of valorizing animal by-products: Evaluate and apply methods for extracting valuable biomolecules, such as proteins and enzymes, from animal waste;

Module Objectives

Learning outcomes	The student will be able to: - Analyze and characterize animal-origin waste and byproducts to assess their potential for recovery and industrial applications, with a focus on sustainability; - Propose innovative approaches for the valorization of animal waste in biotechnology and food recycling, ensuring economic and ecological feasibility; - Critically assess the sustainability of recycling practices for animal waste, identifying opportunities for improvement and alignment with circular economy principles; - Solve problems in dairy and meat processing by reducing wastes, for ecological, economic and health purposes; - Access, evaluate and integrate information from diverse scientific sources, critically assessing emerging methods for their applicability on dairy and meat by-products valorization; - Develop innovative solutions to problems in dairy and meat waste management, by being in continuous learning and self-improvement of technological advancements and emerging trends integrating interdisciplinary knowledge; - Evaluate the social, economic and environmental implications of dairy and meat processing practices and propose sustainable alternatives.								
Content	- Chapter I : Treatment and recovery of waste of animal origin - Section I: Characterization of co-products of animal origin - Section II: Molecules of biological interest - Section III: Applications of co-products in various biotechnological pathways - Chapter II : Extraction of proteins from waste of animal origin - Section I: Case of gelatin - Section II: Digestive enzymes - Section III: Industrial applications - Chapter III : Food recycling of animal waste - Case of reuse of soluble whey proteins Workshops: Study and analyze research papers dealing with animal and dairy byproducts valorization. Practical works: - PW 1: Extraction of gelatin and collagen from slaughterhouse waste - PW 2: Recovery of hemoglobin from bovine blood - PW 3: Valorization of whey								
Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table> <tr> <td>Written mid-term exam</td><td>50%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td>Written final exam</td><td>0%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>30%</td></tr> </table>	Written mid-term exam	50%	Practical works	20%	Written final exam	0%	Quiz/QCM at the end of each main chapter	30%
Written mid-term exam	50%								
Practical works	20%								
Written final exam	0%								
Quiz/QCM at the end of each main chapter	30%								
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	Guide de classification des sous-produits animaux et de leurs devenir http://www.minefe.gouv.fr/directions_services/daj/guide/gpem/table.html								

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M31. Food marketing

Module Name	Food marketing			
Module level	2 nd year			
Code	UET311			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Lobna ESSID			
Lecturer	Sofien BENKAJI			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	DMPT	x		S3
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21 hrs	15-20 students
	Workshop		0 hrs	
	PW		0 hrs	15-20 students
Workload	Total	21 hrs	Self-study	7 hrs
Credit points	1		Coefficient	0.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Introduction to Marketing - Consumer Behavior - Principles of Economics - Business Statistics - Introduction to Food Science - Digital Marketing Fundamentals			

Module Objectives

- Understand the fundamentals of marketing and how they apply to the food industry.
- Analyze consumer behavior and preferences in the context of food products.
- Conduct market research to gather insights about the food market.
- Develop branding strategies for food products.
- Utilize digital marketing tools and techniques to promote food products.
- Evaluate the impact of sustainability on food marketing.
- Create comprehensive marketing plans for food products and services.

Learning outcomes

- Students will grasp the core principles of marketing and their specific applications within the food industry.
- Students will be able to evaluate consumer preferences, motivations, and purchasing behaviors related to food products.
- Students will develop skills to design, implement, and interpret market research studies to gather relevant insights for food marketing strategies.
- Students will learn to create and position strong, recognizable brands for food products, considering factors like brand identity, packaging, and labeling.
- Students will gain proficiency in using digital marketing platforms and tools, such as social media, SEO and online advertising, to promote food products.
- Students will be able to design and execute detailed marketing plans for food products, incorporating strategic planning, budgeting, and performance measurement.

- Students will be able to communicate effectively with multidisciplinary teams in national and international context in professional manner.
- Engage in continuous learning and self-improvement, critically reflecting on professional practice and regulatory updates in food science and technology.
- Demonstrate autonomy, self direction and initiative in food marketing situations.

Content	Module 1: Introduction to Food Marketing • Overview of Marketing Principles • The Food Industry Landscape • Importance of Marketing in the Food Sector Module 2: Consumer Behavior in Food Marketing • Understanding Consumer Preferences and Trends • Psychological and Sociological Factors Influencing Food Choices • Market Segmentation and Targeting Module 3: Market Research for Food Products • Types of Market Research • Designing and Conducting Surveys • Data Analysis and Interpretation Module 4: Branding in the Food Industry • Brand Identity and Positioning • Packaging and Labeling • Case Studies of Successful Food Brands Module 5: Digital Marketing for Food Products • Social Media Marketing • Search Engine Optimization (SEO) and Content Marketing • Online Advertising and E-commerce Strategies Module 6: Sustainability and Ethical Marketing • Sustainable Food Marketing Practices • Corporate Social Responsibility (CSR) in the Food Industry • Ethical Issues and Consumer Advocacy Module 7: Developing a Food Marketing Plan • Components of a Marketing Plan • Strategic Planning and Implementation • Budgeting and Performance Measurement Module 8: Case Studies and Industry Insights • Analysis of Real-world Food Marketing Campaigns • Guest Lectures from Industry Experts • Group Projects and Presentations								
Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table> <tr> <td>Written mid-term exam</td><td>50%</td></tr> <tr> <td>Practical works</td><td>0%</td></tr> <tr> <td>Written final exam</td><td>0%</td></tr> <tr> <td>Group work presentation</td><td>50%</td></tr> </table>	Written mid-term exam	50%	Practical works	0%	Written final exam	0%	Group work presentation	50%
Written mid-term exam	50%								
Practical works	0%								
Written final exam	0%								
Group work presentation	50%								

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	▪ “Food Marketing and Distribution” by Jane M. Jones ▪ “Consumer Behavior in Food and Healthy Lifestyles” by Isaac Galanakis ▪ “Digital Marketing for Dummies” by Ryan Deiss and Russ Henneberry ▪ Industry Reports and Market Research Databases ▪ Online Marketing Tools and Platforms (e.g., Google Analytics, Hootsuite)

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M32. Innovation and entrepreneurship II

Module Name	UET312: Innovation and entrepreneurship II			
Module level	2 nd year			
Code	UET312			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Lobna ESSID			
Lecturer	Lobna ESSID			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S3
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21 hrs	15-20 students
	Workshop		0 hrs	
	PW		0 hrs	15-20 students
Workload	Total	21 hrs	Self-study	30 hrs
Credit points	2		Coefficient	1
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Statistics - Bioethics - Entrepreneurship - Management			

Module Objectives

- Equip students with the skills to develop, implement, and manage advanced innovation strategies within organizations, including evaluating innovation metrics and adapting processes to enhance creativity and efficiency.
- Enable students to understand and apply various funding sources, create robust financial projections, and determine the valuation of startups, preparing them to make informed financial decisions and pitch to investors effectively.
- Provide students with the ability to design and execute comprehensive market research, validate business ideas through customer feedback, and analyze market data to refine and inform business strategies.
- Teach students to manage the product development lifecycle from ideation through to launch and iteration, focusing on creating prototypes, managing product evolution, and applying lifecycle management principles.
- Guide students in designing, testing, and refining innovative business models using tools like the Business Model Canvas, and adapting these models based on feedback and changing market conditions.
- Prepare students to develop and implement effective strategies for scaling businesses, including expansion and managing growth-related challenges, ensuring they can navigate and capitalize on opportunities for business growth.

Learning outcomes

- Develop a strong understanding of Lean Startup fundamentals.
- Apply creative thinking techniques (e.g., brainstorming, SCAMPER, mind mapping) to generate innovative ideas addressing real-world challenges in the meat and dairy industry.

- Identify user needs and problem statements through empathy mapping and problem-framing exercises.
- Develop and refine ideas using structured ideation methods such as design thinking and Lean Startup principles.
- Design, test, and refine business models using tools such as the Business Model Canvas.
- Formulate and implement strategic plans for startups, demonstrate effective leadership in team environments, and address key entrepreneurial challenges.
- Develop innovative solutions to novel problems in dairy and meat science, balancing conflicting goals and integrating interdisciplinary knowledge.
- Communicate innovative ideas with multidisciplinary teams in national and international context, and demonstrate autonomy, self-direction, initiative and effective decision making in a professional manner.
- Be in continuous learning and self-improvement and staying abreast of innovation technologies and updates in food marketing.

Content

Chapter 1: Introduction to innovation and entrepreneurship

- Definitions and concepts
- Typology
- Innovative start-ups
- Innovations in biotechnology
- Ideation Workshop

Chapter 2. Design thinking process

- Definition and concepts
- Phases of design thinking: empathize, define, ideate, prototype, test
- Creativity and innovation tools (SCAMPER, Brainstorming, mindmapping...)
- Creativity workshop: the SCAMPER
- Design thinking workshop: aligning the user experience with the customer segment

Chapter 3: Economic intelligence and innovation

- Definitions and concepts
- Typology of Economic intelligence
- Economic intelligence for innovation
- Economic intelligence workshop: patent intelligence
- Societal intelligence workshop

Chapter 4 Business Model Canvas and Innovation

- Foundation of the business model
- Core elements of the business model
- Building blocks of the business model
- Workshop: Building the BMC using the Canvas tool

Study and examination requirements and forms of examination

Mixed evaluation
The final score is weighted as follows:

Written mid-term exam	70%
Practical works	00%
Teamwork project	30%
Written final exam	00%
Quiz/QCM at the end of each main chapter	00%

Media employed

Digital presentations, Lab work manual, and ISBB Extranet (<https://isbb.rnu.tn/>) for course material sharing

Reading list

- "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail" by Clayton M. Christensen.
- "The Art of Startup Fundraising" by Alejandro Cremades.
- "The Lean Product Playbook: How to Innovate with Minimum Viable Products and Rapid Customer Feedback" by Dan Olsen
- "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" by Alexander Osterwalder and Yves Pigneur

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M33: Biostatistics II

Module Name	UET313: Biostatistics II			
Module level	2 nd year			
Code	UET313			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Wael TAAMALLI			
Lecturer	Wael TAAMALLI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT	x		S3
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Integrated course		28 hrs	15-20 students
	Workshops		0 hrs	
	PW		0 hrs	
Workload	Total	28 hrs	Self-study	2 hrs
Credit points	1		Coefficient	0.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Applied mathematics - Biostatistics I			

Module Objectives

- Deepen the students understanding of advanced statistical methods
- Equip students with the skills to design complex experiments and analyze multivariate data.
- Enable students to apply statistical techniques to solve real-world problems in food science.

Learning outcomes

- Design and analyze advanced experiments
- Apply multivariate statistical methods to analyze complex datasets
- Utilize advanced regression models for predictive analytics in food research.
- Critically evaluate and interpret statistical results
- Apply mathematical and statistical models to interpret results; communicate statistical findings through scientific reports
- Use statistical programs for experimental design and analysis of experimental data and interpret the results.
- Conduct research autonomously, critically interpreting data to draw well-supported conclusions.

Content

- Review of Biostatistics I Concepts
- Advanced Experimental Design
- Multivariate Analysis Techniques
- Advanced Regression Analysis
- Ethical Considerations in Biostatistics

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table> <tr> <td>Written mid-term exam 1</td><td>45%</td></tr> <tr> <td>Practical works</td><td>00%</td></tr> <tr> <td>Written mid-term exam 2</td><td>45%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>10%</td></tr> </table>	Written mid-term exam 1	45%	Practical works	00%	Written mid-term exam 2	45%	Quiz/QCM at the end of each main chapter	10%
Written mid-term exam 1	45%								
Practical works	00%								
Written mid-term exam 2	45%								
Quiz/QCM at the end of each main chapter	10%								
Media employed	Practical sessions are conducted in a computer lab. Exercises are solved using specialized software								
Reading list	• "Design and Analysis of Experiments" by Douglas C. Montgomery • "Applied Multivariate Statistical Analysis" by Richard A. Johnson and Dean W. Wichern • "Practical Statistics for Food Scientists: Making Sense of the Numbers" by Jim T. Kapsalis.								

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A. Internship in a professional setting

Module Name	Internship in a professional setting			
Module level	1st year			
Code				
Semester(s) in which the module is taught	At the end of semester 2 (1 month in summer vacation)			
Person responsible for the module	Internship Director			
Lecturer				
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Dairy and Meat Products Applied Technologies (DMPT)	x		
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	- Work on a professional environment to understand the day-to-day tasks of technicians. - Have a briefing with the industrial supervisor to address any question about the activities in the site.			
Workload	120 H			
Credit points	4	Coefficient	2	
Requirements according to the examination regulations	Students will demonstrate their progress by the following: ▪ Recording notes about their daily tasks & activities ▪ Submitting a manuscript by the specified deadline			

Module Objectives

- Introduce students to professional environments in the dairy and meat sectors.
- Enable students to observe and understand industrial processes, hygiene and safety protocols, and organizational structures.
- Begin applying academic knowledge in real-world contexts.
 - Develop interpersonal and communication skills within a professional setting.

Learning outcomes

By the end of this internship, students will be able to:

- Describe the structure, operations, and workflow of a dairy or meat processing facility.
- Analyze and contribute to the resolution of a practical issue in the dairy or meat industry.
- Apply hygiene, safety, and traceability practices as observed in the workplace.
- Reflect critically on their professional experience, including practices, organization, and culture.
- Report and summarize key results and learning points in a structured written format.
- Demonstrate interpersonal and communication skills in a professional setting.

Content

- Observation of production and quality control operations
- Overview of hygiene, safety, and environmental practices
- Participation in analyzing and resolving technical issue
- Introduction to documentation, traceability, and regulatory compliance
- Reflection on company structure, communication practices, and industrial culture
- Preparation of an internship report summarizing key observations and learning points

Study and examination requirements and forms of examination

Student need to present an internship report to the Internship Director.

Media employed

Reading list

internship notebook

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B. Graduation research project internship

Module Name	Graduation research project internship			
Module level	2 ^{sd} year			
Code				
Semester(s) in which the module is taught	S4			
Person responsible for the module	Internship Director			
Lecturer				
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Dairy and Meat Products Applied Technologies (DMPT)	x		4
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	- Work on a professional environment to understand the day-to-day tasks of technicians. - Have a briefing with the industrial and academic supervisors to address any question about the activities in the site.			
Workload	900 H			
Credit points	30	Coefficient	15	
Requirements according to the examination regulations	Students will demonstrate their progress by the following: ▪ Recording notes about their daily tasks & activities ▪ Submitting a manuscript by the specified deadline ▪ Defending the final thesis publicly			

Module Objectives

- Allow students to engage in in-depth work on a technical or research project in collaboration with industry or academic partners.
- Apply scientific and technical skills to address real problems in dairy or meat processing.
- Develop autonomy, critical thinking, and project management abilities.
- Produce and defend a master's thesis based on the work conducted.

Learning outcomes

By the end of this internship, students will be able to:

- formulate and solve problems arising in new and developing fields of the area of dairy or meat industry.
- Conduct independent research and contribute to scientific and/or industrial knowledge in food science and technology.
- Access, evaluate, and synthesize scientific literature and emerging technologies, methods and materials relevant to dairy and meat processing.
- Use advanced scientific methods, conduct experiments, analyze and assess data critically, and develop solutions for unusual problems.
- Conduct research autonomously, critically interpreting data to draw well-supported conclusions and advancing the scientific knowledge base in food science and technology.
- Develop innovative solutions to complex and novel problems in dairy and meat science
- Engage in continuous learning and self-improvement, critically reflecting on professional practice
- Communicate findings effectively in writing by producing a structured, scientifically rigorous thesis.
- Present findings orally with clarity and professionalism in front of an academic and/or industry panel.
- Demonstrate professional conduct, including initiative, responsibility, and ethical awareness in a work environment.

Content	- Selection and definition of a project topic in agreement with academic and industrial supervisors - In-depth literature review and methodological design - Data collection, experimentation and/or implementation - Analysis and interpretation of results - Writing of a structured thesis - Oral defense of the thesis before an academic and professional panel
Study and examination requirements and forms of examination	Submit and defend the final year project thesis publicly
Media employed	
Reading list	internship notebook Guidelines for writing the final year project thesis

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M. Diagnosis of the agricultural operations and the livestock system

Module Name	Diagnosis of the agricultural operations and the livestock system			
Module level	1 st year			
Code	UEO111			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Slimen SELMI			
Lecturer	Slimen SELMI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT		x	S1
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	7 hrs		
	PW	0 hrs	10-20 students	
Workload	Total	28 hrs	Self-study	50 hrs
Credit points	3		Coefficient	1.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of planned contact hours - An absenteeism rate > 20% = elimination of module exams			
Recommended prerequisites	Management			

Module Objectives	- Analyze production systems and diagnose and identify the problems that can be in the agricultural operation. - Identify alternative solutions, produce recommendations for the farmer. - Write a report about the provided solutions and recommendations.
Learning outcomes	- The student is able to analyze the production systems. - The student is able to diagnose and identify the problems that arise within the agricultural operation. - The student is able to identify alternative solutions, produce recommendations for the farmer, and write a report on the situation and recommendations. - The student is able to solve problems related to agricultural operations under supervision and write a report following standard conventions.

Content	Chapter 1: Methodology and approach to conduct diagnosis and identify exploitation issues Chapter 2: The dynamics of exploitation Chapter 3: Problems related to performance, health, and animal well-being - Interactions related to the identified problem Chapter 4: Diagnosis at the herd level and situating within the exploitation Chapter 5: Critical review of the available literature on the agricultural performance Chapter 6: Workshops - Student presentations on the production system operations and diagnosis of problems that hinder their development - Student reports justifying and validating the recommendations made for the farmer and their impact on the functioning and profitability of the farm. Practical works: Study trips to agricultural company for the Development of Livestock
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Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table> <tr> <td>Written mid-term exam</td><td>40%</td></tr> <tr> <td>Workshops</td><td>40%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> </table>	Written mid-term exam	40%	Workshops	40%	Practical works	20%
Written mid-term exam	40%						
Workshops	40%						
Practical works	20%						

Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/
Reading list	■

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M. Farm Management				
Module Name	Farm Management			
Module level	1 st year			
Code	UE0112			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Slimen SELMI			
Lecturer	Slimen SELMI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT		x	S1
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	3,5 hrs		
	PW	10,5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	40 hrs
Credit points	3		Coefficient	1.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of planned contact hours - An absenteeism rate > 20% = elimination of module exams			
Recommended prerequisites	- Management - General economics			

Module Objectives	- Learn the operations inside a company and the reasons through decisions making - Learn how to use appropriate company management tools - Understand the use of the technical, economic and financial results for the operation and the guide of a company function.
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Learning outcomes	- Understand how a company operates and reason through decisions using appropriate management tools - Establish, analyze and use the technical-economic and financial results of the operation to regulate and guide its functioning. - Demonstrate a critical understanding of the role of food provenance in maintaining food quality.
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Content	Chapter 1 - The treasury of the agricultural enterprise 1- Definition and measurement 2- The management of treasury surpluses and deficits Chapter 2 - The working capital of the agricultural business 1- The different types of working capital 2- The rule of minimum financial balance 3- The improvement of working capital 4- The need for working capital Chapter 3 - The financial flows of the agricultural enterprise 1- The multiannual financial flow table 2- The new performance indicators 3- Management recommendations based on financial flows Chapter 4 - Long and medium term financing of investments 1- Financing ratios 2- The relationship between financings and old and new investments 3- The search for new resources Chapter 5: The results and profitability of the agricultural enterprise 1- General economic results 2- Specific economic results of the agricultural sector 3- Disposable income 4- Profitability ratios 5- The size of the enterprise Chapter 6: Agricultural taxes 1- Value-added tax 2- Corporate income tax
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3- Global income tax

Practical works:

Study trips to:

- MARJA Company for the Development of Livestock and Agriculture (SMADEA)
- The Office of State Lands (OTD)

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	40%
	Written mid-term exam	40%
	Practical works	20%
Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/	
Reading list		

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M. Bioreactors				
Module Name	Bioreactors			
Module level	1 st year			
Code	UEO211			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Haifa SEBII			
Lecturer	Haifa SEBII			
Language	French			
Relation to curriculum	Programme		Compulsory	Elective
	DMPT			x
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21 hrs	20-40 students
	Workshop		3.5 hrs	
	PW		10.5 hrs	10-20 students
Workload	Total	35 hrs	Self-study	40 hrs
Credit points	3		Coefficient	1.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of planned contact hours - An absenteeism rate > 20% = elimination of module exams			
Recommended prerequisites	Food Biochemistry and microbiology			

Module Objectives	- Understand the fundamental principles of bioreactor design and operation: - Define what a bioreactor is and explain its importance in bioprocess industries (pharmaceuticals, food, environmental, etc.). - Differentiate between batch, fed-batch, continuous, and specialized bioreactor systems (e.g., airlift, fluidized bed, membrane bioreactors). - Monitor and control critical variables like temperature, pH, agitation, aeration, and dissolved oxygen. - Apply mathematical models to describe microbial growth, substrate consumption, and product formation. - Understand the challenges and strategies in scaling up from laboratory to industrial scale. - Familiarize with sensors, probes, and automated control strategies in bioreactor systems.
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Learning outcomes	- Define and describe the main types and components of bioreactors. - Explain the principles of microbial growth, substrate utilization, and product formation in bioreactors. - Operate small-scale laboratory bioreactors and set key process parameters (temperature, pH, agitation, aeration). - Analyze and interpret microbial growth kinetics data. - Model and calculate bioprocess parameters (e.g., growth rate, yield coefficients, productivity). - Evaluate the influence of bioreactor design and operation on process performance. - Understand the basics of scale-up principles and challenges when moving from lab-scale to industrial-scale bioreactors. - Demonstrate knowledge of process monitoring, control, and instrumentation in bioreactor systems.
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Content	I. Introduction to Bioreactors - Definition and importance - Types of Bioreactors - Batch, Fed-batch, Continuous (CSTR) - Mechanically agitated tanks - Aerated mechanically agitated tanks - Bubble columns - Airlift reactors - Fixed or fluidized bed reactors II. Bioreactor Components and Design - Vessel, agitation system, sparger, baffles, sensors
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III. Mass and Heat Transfer in Bioreactors

- Oxygen transfer rate (OTR),
- Heat generation and removal
- Aeration and Agitation
- Gas-liquid mass transfer
- Scale-up considerations for oxygen transfer

IV. Bioreactor Instrumentation and Control

- pH control, temperature control, DO sensors, foam control
- Scale-Up and Scale-Down Principles
- Geometric, kLa, and power-based scale-up strategies

V. Microbial Growth Kinetics

- Growth phases, specific growth rate (μ), Monod equation
- Substrate utilization and product formation
- Couplings between biochemical reactions and material transfer:
 - Kinetics of enzymatic reactions
 - Yields and kinetics of cell growth and production reactions
 - Coupling between biochemical reaction and liquid-solid material transfer
 - Coupling between biochemical reaction and diffusion within a porous solid support
 - Coupling between biological reaction and gas-liquid material transfer

VI. Downstream Impact of Bioreactor Operations

- Relationship between upstream (fermentation) and downstream processes

VII. Bioreactor Applications in Food

- Applications in industry
- Enzymatic reactor
- Production of baking yeast

Workshops

- Group presentations on case studies or bioprocess design

Practical work

- **PW 1:** Hydrolysis of milk proteins by industrial enzymes.
- **PW 2:** Study of the hydrodynamic performance of an enzymatic bioreactor.
- **PW 3:** Study of the production of yeast cells in fed-batch fermentation process.

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	35%
	Written mid-term exam	35%
	Practical works	20%
	Teamwork presentations	10%
Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/	
Reading list	▪ Shuler, M. L., & Kargi, F. (2017). Bioprocess Engineering: Basic Concepts (3rd Edition). Pearson. ▪ Doran, P. M. (2012). Bioprocess Engineering Principles (2nd Edition). Academic Press. ▪ Stanbury, P. F., Whitaker, A., & Hall, S. J. (2017). Principles of Fermentation Technology (3rd Edition). Butterworth-Heinemann.	

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M. Rheology of food systems

Module Name	Rheology of food systems			
Module level	1 st year			
Code	UEO212			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Haifa SEBII			
Lecturer	Haifa SEBII			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	Elective	<i>Semester</i>
	DMPT		x	S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	3,5 hrs		
	PW	10,5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	40 hrs
Credit points	3		Coefficient	1.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of planned contact hours - An absenteeism rate > 20% = elimination of module exams			
Recommended prerequisites	Food biochemistry			

Module Objectives

- Define rheology and explain its importance in food science and food engineering.
- Identify different rheological behaviors of food materials:
- Differentiate between Newtonian and Non-Newtonian fluids.
- Recognize viscoelastic properties in food systems.
- Master techniques for rheological measurements:
- Understand the working principles of common rheological instruments (e.g., viscometers, rheometers).
- Follow correct experimental protocols for measuring food rheological properties.
- Link rheological properties to industrial applications and food quality:
- Understand how rheology affects processing, transport, packaging, and sensory perception of food products.

Learning outcomes

- Describe and explain the rheological properties of food systems.
- Classify foods according to their rheological behavior (fluid, semi-solid, viscoelastic solid).
- Operate rheological instruments (viscometer, rheometer) to measure viscosity and other flow properties.
- Interpret experimental data and model food behavior using appropriate rheological equations (e.g., Newton's law, Power Law, Bingham Plastic, Herschel-Bulkley models).
- Apply rheological principles to solve industrial food processing problems (e.g., formulation, extrusion).

Content

I. Basic Concepts of Rheology

- Definition and scope
- Importance in food industry
- Stress, strain, deformation, shear rate

II. Rheology of food fluids

1. Viscosity law

- 1.1. Viscosity definitions and units
- 1.2. Shear stress
- 1.3. Velocity gradient
- 1.4. Flow and viscosity curves

2. Rheological behavior of food fluids

- 2.1. Newtonian fluids
- 2.2. Non-Newtonian fluids with time-independent behavior

- 2.3. Non-Newtonian fluids with time-dependent behavior
- 2.4. Viscoelastic fluids
- 2.5. Examples in food systems
- 3. Measurement Techniques
 - Capillary viscometers
 - Falling ball and rolling ball viscometers
 - Rotational rheometers
 - Penetrometers
 - Experimental design and error sources

III. Rheology of food solids

1. Compression test
2. Bending test
3. Penetration test
4. Stretching test (uniaxial tension)
5. Shear test
6. Creep and relaxation
7. Instrumental analysis of texture profile (TPA)

IV. Rheology of gels

1. Viscoelastic behavior of gels
2. Gels and the theory of 'rubber-like' elasticity
3. Breaking stress of gels

V. Effect of Temperature, Concentration, and Composition

- Influence on viscosity and flow behavior

VI. Rheology of Specific Food Systems

- Dairy products
- Sauces, emulsions, and suspensions
- Bakery products
- Applications in Food Processing
 - Pumping, mixing, extrusion
 - Process design considerations

Workshops:

- Student presentations on selected food systems and their rheological behavior

Practical works:

- **PW 1:** Determination of the viscosity of some dairy products.
- **PW 2:** Analysis of the texture profile of some types of cheese.
- **PW 3:** Study of the hardness and the viscosity of some meat products.

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	35%
	Written mid-term exam	35%
	Practical works	20%
	Teamwork presentations	10%
Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/	
Reading list	▪ Sahin, S., & Sumnu, G. (2006). Physical Properties of Foods. Springer. ▪ Rao, M. A. (2014). Rheology of Fluid and Semisolid Foods: Principles and Applications. Springer. ▪ Bourne, M. C. (2002). Food Texture and Viscosity: Concept and Measurement. Academic Press.	

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M. Health Nutrition and Dietetics				
Module Name	Health Nutrition and Dietetics			
Module level	2 nd year			
Code	UEO312			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Dhouha ALIM			
Lecturer	Dhouha ALIM			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	DMPT		x	S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 Students	
	Workshop	3.5 hrs		
	PW	10.5 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	25 hrs
Credit points	2	Coefficient	1	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours ➤ 20 % of nonattendance = elimination for exams			
Recommended prerequisites	- Basic concepts in Human biology - Food biochemistry - Physicochemical analysis techniques			

Module Objectives	- Acquire a foundational understanding of human nutrition and digestive physiology. - Identify nutritional needs at different life stages. - Assess individual or group nutritional status. - Understand energy metabolism fundamentals.
Learning outcomes	- Identify and understand current scientific concepts related to nutrition and human health. - Adapt dietary requirements considering age and physiological or pathological states. - Establish dietary advice to prevent malnutrition and comorbidities associated with aging. - Design and manage a project (planning, leadership, team coordination, dissemination) that integrates multidisciplinary skills within a collaborative framework. - Communicate effectively with health professionals and beneficiaries to promote healthy eating behaviors.
Content	Chapter I – Fundamental Concepts of Nutrition - Definition and Scope of Nutrition - Classification of Nutrients - Principles of Nutritional Balance Chapter II – What is Dietetics? - The science of balanced nutrition - Adaptation to the age and activity of the individual - Dietary balances in major cultures Chapter III – Dietary Excesses and Their Impact on Health - Fundamental Principles of Dietetics - Balance between proteins, carbohydrates, and fats - Dietary evaluation of fatty acids - The importance of trace elements - Vitamin intake - Fresh fruits, vegetables, dietary fibers - The amount of water to be consumed -Knowing Energy Needs - Evaluating Energy Needs in kJ - The energy value of different foods -Monitoring intake balance - Creating balanced menus Chapter IV – Nutritional and Metabolic Pathologies - Nutritional anemias

2. Reactive hypoglycemia
3. Digestive disorders: Constipation, Diarrhea, and Diverticulosis
4. Overweight and Obesity

Chapter V – Food deficiency

1. - The specifics of precariousness: physiological, psychological, nutritional deficiencies
2. - Pathologies (Malnutrition, undernourishment, diabetes, hypertension, cardiovascular risks the illusion of balance, anorexia, bulimia, addictions)
3. - Purchasing (the different ways of buying, Food and budget)

Chapter VI – Nutritional Management of Chronic Diseases

1. Diabetes Mellitus: Dietary principles
2. Obesity: Nutritional strategies and lifestyle modifications
3. Nutritional requirements in febrile conditions
4. Other metabolic disorders: Dyslipidemia
5. Multidisciplinary approach and professional collaboration

Workshops:

- Teamwork presentations on evaluating the energy values of some foods; Creating balanced menus, Monitoring food intake balance
- Designing a dietary plan adapted to a nutritional pathology (e.g., hypertension, diabetes).

Practical works:

PW1: Analysis of the nutritional composition / energy value of a food item.

PW2: Study of the impact of cooking on nutritional value.

PW3: Biological assays (blood sugar, cholesterol level, triglycerides, HDL, LDL, VLDL, urea, proteins, creatinine...etc.).

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows: <table border="1"> <tr> <td>Written mid-term exam</td><td>35%</td></tr> <tr> <td>Written mid-term exam</td><td>35%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td>Teamwork presentations</td><td>10%</td></tr> </table>	Written mid-term exam	35%	Written mid-term exam	35%	Practical works	20%	Teamwork presentations	10%
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Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	* College of Nutrition Teachers. (2012). Nutrition. Paris : Elsevier Masson. ISBN 978-2-294-77359-4. 557p. *Auvinet, E., Hirschauer, C., & Meunier, A.-L. (2021). Food, nutrition and diets: knowledge, tools, applications. Paris: Lavoisier. ISBN: 978-2-7590-4668-3. 1068 p. *Schlienger, J.-L. (2018). Practical clinical nutrition – In adults, children and the elderly. Paris : Elsevier Masson. ISBN 978 2 294 75468 5. 392 p.								

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Lecturer	Dhouha ALIM			
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