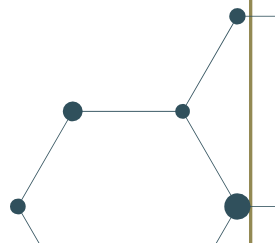


B.S. in Food Science and
Technology, Food Industry
and Processing Option programme

FIP

MODULE HANDBOOK



 INSTITUT SUPÉRIEUR DE BIOTECHNOLOGIE DE BÉJA المعهد العالي للتكنولوجيا البيئية	Module Handbook Food Industry and Processing (FIP)	ENR-CD-06 06/02/2023
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1. Applied Mathematics

Module Name	Applied Mathematics				
Module level	1st year				
Code	UEF111				
Semester(s) in which the module is taught	Semester 1 (S1)				
Person responsible for the module	Imen Rassas				
Lecturer	Imen Rassas				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	Food Quality Control (FQC)		x		S1
	Food industry & processing (FIP)		x		S1
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		21hrs	20-40 students	
	Workshop		14hrs	20-40 students	
	PW				
Workload	Total	35hrs	Self-study	40	
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	Requires basic knowledge of mathematics				

Module Objectives

- Equip students with foundational mathematical knowledge and tools necessary for understanding, utilizing, and developing mathematical models. Familiarize students with descriptive methods, the concept of random variable, the basic distributions, and statistical inference.
- Enhance student's ability to communicate using mathematical and statistical language, enabling them to formulate and solve problems.
- Foster scientific rigor, logical reasoning, critical thinking skills and decision making.

Learning outcomes

- Analyze real-valued functions and apply limits, derivatives, and integrals to solve problems.
- Solve first- and second-order differential equations and apply them to scientific models.
- Apply partial derivatives and optimization techniques for multi-variable functions.
- Use matrix operations to solve linear systems in scientific contexts.
- Apply elementary probability theory to solve problems involving random events.
- Use statistical methods to analyze data, estimate population parameters, perform hypothesis testing, Interpret the results obtained and draw conclusions.

Content

I. Functions of a Real Variable

- Review: Domain of definition, operations on functions (power functions, polynomial, rational, trigonometric, exponential, and logarithmic functions).
- Differentiability: Taylor series (up to second or third order), expansions, limits, approximations, examples, and applications.
- Graphical representations.
- Antiderivatives and Integrals: Definitions, calculation methods (change of variables and integration by parts).

II. Differential Equations

- Definitions and examples.
- First-order linear differential equations: Resolution methods and applications.
- Second-order linear differential equations with constant coefficients: Resolution methods and applications.

III. Functions of Several Variables

- Definitions and examples (limited to two variables).
- Partial derivatives, finding extrema of a function, gradient, and applications.

IV. Matrix Calculus and Systems of Linear Equations

- Definition of a matrix, operations on matrices, inversion of square matrices.
- Applications: Solving linear systems.

V. Elementary Probability

- Introduction to combinatorial analysis.
- Probability spaces: Illustrated with simple examples.
- Conditional probabilities and independent events.
- Discrete random variables and common probability distributions.

VI. Statistics

- Statistical sampling: Representation of data (statistical series, statistical tables).
- Estimation: Definition and properties of an estimator, point and interval estimation.
- Significance tests: General procedure, significance level of a test, comparison tests.
- Chi-square goodness-of-fit test.

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	30%
	Practical works	0%
	Written final exam	70%
	Quiz/QCM at the end of each main chapter	0%
Media employed	https://www.maths-cours.fr/ , https://isbb.rnu.tn/	
Reading list	▪ Généralités sur les fonctions numériques. ▪ Cours de Probabilités : Pierre DUSART.	

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02. Applied Physics

Module Name	Applied physics			
Module level	1 st year			
Code	UEF112			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Housseem JABRI			
Lecturer	Housseem JABRI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S1
	Food industry & processing (FIP)	x		S1
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	10.5 hrs	20-40 students	
	PW	10.5 hrs	10-20 students	
Workload	Total	42 hrs	Self-study	33 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	▪ Requires some knowledge of physics and mathematics			

Module Objectives

- Understand the basic notions of Physics.
- Understand the laws of mechanics (statics, kinematics, dynamics).
- Understand the basics of electricity: electrostatic fields and potentials, dipole, magnetic field, etc.
- Know of the laws of optics: Descartes; laws, diopters, mirrors, lenses,...

Learning outcomes

The student will be able to:

- Apply mathematical tools (vectors, multivariable functions) to solve physical problems
- Study the different types of movements, calculate the speed and acceleration of a moving object, correctly apply the fundamental relationship of dynamics.
- Calculate the electrostatic field and potential created by discrete and continuous distributions of electric charges. Apply the law of Biot and Savart to filiform circuits.
- Apply the laws of optics to systems such as the plane diopter, plane mirror, spherical mirror, lens.
- Use experimental techniques to measure and verify physical phenomena.

Content

- CHAPTER I: Mathematical Tools for Physics**
 - General
 - Notions, models, theories and fundamental interactions
 - Math reminders
 - Vector calculation
 - Multivariable functions
 - Exercises
- CHAPTER II: Notion of mechanics**
 - Trajectory and motion
 - Speed and acceleration
 - Study of particular movements (uniform, uniformly accelerated, circular)
 - Forces deriving from potential energy
 - Work, Power and Energy (kinetic energy, potential energy, conservation laws)
 - Exercises
- CHAPTER III: Electrostatics and Magnetostatics**
 - Electric charge (quantization, conservation)
 - Continuous distribution of charges (linear, surface, volume)

- III. Coulomb's law
- IV. Electric dipole
- V. Magnetic field (sources, properties, field lines)
- VI. Exercises

▪ **CHAPTER IV: Geometrical Optics**

- I. General concepts (nature of light, propagation)
- II. Ray of light and optical path
- III. Snell-Descartes laws (reflection and refraction)
- IV. Real and virtual images and objects
- V. Stigmatism (definition, conditions)
- VI. Planar systems (plane mirror, diopter)
- VII. Spherical systems (spherical mirrors and lenses)
- VIII. Exercises

- PW1: Focometry (Measurement of focal lengths of optical systems)
- PW 2: Study of the prism (Determination of prism angle and refractive index)
- PW 3: Electric filter (Study of RC and RLC circuits)

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	▪ Physique : Electrocinétiq ue et Optique Géométrique. Ellipses. ISBN : 9782340083486 ▪ Toute la Physique. Dunod. ISBN : 9782100820269	

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3.General Chemistry				
Module Name	General chemistry			
Module level	1 st year			
Code	UEF121			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Abid OUERGHUI			
Lecturer	Abid OUERGHUI			
	Assia OMRANI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Sciences and Technology	x		S1
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21hrs	20-40 students
	Workshop		07	20-40 students
	PW		10.5hrs	10-20 students
Workload	Total	38.5 hrs	Self-study	37 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	Does not require significant knowledge of general chemistry			

Module Objectives	- Understanding Basic Chemical Principles (atomic structure, Chemical bonding, hybridization of atom...) - Learn to balance chemical equations to satisfy the law of conservation of mass. - Understand the concepts of pH, and the pH scale, and how to calculate the pH of various solutions. - Kinetic study of chemical reactions
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Learning outcomes	- Determine the electronic structure of an atom. - Determine the position of an atom in the periodic table in chemistry. - Apply the Gillespie formula to determine the geometry of a chemical molecule and determine the hybridization of the central atom. - Determine the internal energy and predict the direction of a spontaneous transformation of thermodynamic system. - Determine the pH of some aqueous acid-base solutions - Determine the order of a chemical reaction and study the effects of temperature and catalyst on the speed of a chemical reaction
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Content	Course Program CHAPTER I: Emission spectrum of the hydrogen atom CHAPTER II: Chemical structures of atoms CHAPTER III: Classification of chemical elements in the periodic table CHAPTER IV: The molecular building blocks CHAPTER V : Acid-base reactions CHAPTER VI : Application of the first and second law of thermodynamics CHAPTER VII : Chemical equilibrium CHAPTER VIII : Kinetics of chemical reactions Workshop Program PW1: Titrable acidity of milk. PW2: Titration of active chlorine in commercial bleach solution.
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- **PW3:** Kinetic study of chemical reaction
- **Directed Works**
- **Series-1:** Constituents of the atom, spectrum of the hydrogen atom, Bohr model, Isotopes.
- **Series-2:** Electronic configuration of atoms and classification of chemical elements in the periodic table.
- **Series-3:** Electronic configuration of atoms.
- **Series-4:** Chemical bonds and hybridization
- **Series-5:** pH of aqueous solutions
- **Series-6:** The first and second law of thermodynamics
- **Series-7 :** Chemical equilibrium
- **Series-8:** Kinetic of chemical reactions

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
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Reading list	CHIMIE PCSI, Les nouveaux précis Bréal, Edition : Julien Barret, Bréal 2003, ISBN2749502330.
	▪

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04. Organic chemistry				
Module Name	Organic Chemistry			
Module level	1 st year			
Code	ECUEF122			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Azhar HAJRI			
Lecturer	Azhar HAJRI			
	Mariem SMADHI and ASSIA OMRANI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S1
	Food industry & processing (FIP)	x		S1
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21 hrs	20-40 students
	Workshop		7 hrs	20-40 students
	PW		10.5 hrs	10-20 students
Workload	Total	38.5hrs	Self-study	37 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	Does not require significant knowledge of organic chemistry			

Module Objectives	- Know how to make the link between the formulas and the scientific names of organic molecules. - Know how to recognize several organic functional groups - Know the different representations of organic molecules - Know the stereochemistry of organic molecules - carrying out organic synthesis (synthesis of aspirin, banana flavor)
Learning outcomes	- Name organic compounds - Distinguish between the different types of isomerism (structural isomers, geometric isomers and stereoisomers) - Recognize and represent the functional group(s) of the main families of organic compounds - Establish relationships between the molecular and spatial structures of organic molecules and some properties, including their reactivity - Predict and explain the expected result of the main types of organic reactions, by linking them to their mechanism
Content	CHAPTER I: Organic compounds, Formulas, functions, systematic nomenclatures (IUPAC) - Formula of organic compounds - Functions, functional groups - Nomenclatures - Hybrid orbitals CHAPTER II: Isomerism and stereoisomerism - Elemental analysis - Definition of isomerism - Structural isomerism - Stereoisomerism - Conformational study of acyclic compounds CHAPTER III: Chemical properties of Hydrocarbons (Alkanes, Alkenes, Alkynes) - Alkanes II. - Alkenes - Alkynes

CHAPTER IV: Chemical properties of Alcohols, Phenols and amines

I. Alcohols

II. Amines

CHAPTER V: Chemical properties of Aldehydes and Ketones

I. Aldehydes

II. Ketones

Practical work

- PW 1: Saponification reaction: Synthesis of a soap
- PW 2: Acetylation reaction: Synthesis of aspirin
- PW 3: Synthesis of an odorous compound, isoamyl acetate

Workshop

- Systematic nomenclatures (IUPAC)
 - Elemental analysis, Sequential rule
 - Stereochemistry
 - Chemical properties of alkanes, alkenes, alcohols, etc.
-

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	▪ René Milcent, Stéréochimie, entités réactives et réactions. ISBN : 978-2-86883-875-9 ▪ Paul Arnaud, chimie organique et exercices résolus, 3e Edition. ISBN 2-10-003515-0	

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5. Cell biology

Module Name	Cell biology/Genetics			
Module level	1 st year			
Code	UEF131			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Yosra BOURAOUI			
Lecturer	Yosra BOURAOUI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S1
	Food industry & processing (FIP)	x		S1
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21hrs	20-40 students	
	Workshop	7 hrs		
	PW	10.5 hrs	10-20 students	
Workload	Total	38.5 hrs	Self-study	37 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	▪ None prerequisites.			

Module Objectives

- Known correctly use appropriate cell biology terminology on exams and written assignments
- Describe and explain the common themes in cell biology: balance of molecules, protein conformation use of cellular energy (ATP).
- Design appropriate experiments to investigate cellular processes.
- Have the required knowledge to understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.

Learning outcomes

- Describe the evolution, diversity and replication of cells.
- Explain the role of each compartment and signalling in cell biology.
- Interpret and demonstrate key experiments in the history of cell biology.
- Evaluate and apply knowledge of modern techniques in cellular biology.
- Evaluate and apply knowledge of modern techniques in cellular biology.

Content

CHAPTER I: Introduction to Cell biology

- Fundamentals properties common to different cell types
- Cell Classification
 1. Prokaryotic cell:
 2. Eukaryotic cell:
- Cellular component of cell
 - 3.1. Water
 - 3.2. Organic molecules (proteins, carbohydrates, lipids, nucleic acid)
 - 3.3. Mineral salts

CHAPTER II: Plasmic membrane

- Properties
 - 1.1. Structure and ultrastructure
 - 1.2. Fluid mosaic pattern
 - 1.2.1. Organization and role of lipids
 - 1.2.2. Organization of proteins

- Transmembrane proteins
- Intrinsic and extrinsic proteins
- 2. Role of membrane proteins
- 2.1. membrane protein transport
- 2.1.1. Simple diffusion
- 2.1.2. passive transport
- 2.1.3. active transport
- 2.2. Endocytosis and penetration of substances into the cell by endocytosis
- 2.2.1. Pinocytosis
- 2.2.2. Phagocytosis
- 2.3. Exocytosis

CHAPTER III : CYTOSKELETON

- 1. Microtubules
- 1.1. Molecular structure
- 1.2. Organisation
- 1.3. Interaction with cellular organelles.
- 2. Actin filaments
- 2.1. Structure, composition and localization
- 2.2. Function.
- 2.2.1. Association of myosin and actin filaments
- 3. Intermediate filaments
- 3.1. Structure and different types of intermediate filaments
- 3.2. Function

CHAPTER IV: Cellular Organelle Organization and functional compartmentation

- 1. 1. Organelles with double membranes: mitochondria and chloroplasts
- 1.1. Structure, ultrastructure and function of mitochondria
- 1.2. Structure, ultrastructure and function of chloroplasts
- 2. Nucleus
- 2.1. Structure and organization of the nucleus
- 2.2. Nucleolus
- 2.3. Cellular reproduction in eukaryotic cell
- 2.3.1. Reproduction and cellular cycle
- G1, S, G2 and M
- Mitosis
- Meiosis
- 3. Endomembrane system
- 3.1. Endoplasmic Reticulum
- 3.2. Golgi apparatus
- 3.3. Lysosome
- 3.4. Peroxisome

Practical work

- **PW1:** Initiation to use photonic microscope.
- **PW2:** Observation and coloring of eukaryotic cell (blood smear, buccal epithelium, amoeba, onion bulb...)
- **PW3:** Study of ultrastructure of cell: organelles.
- **PW4:** Permeability of membrane
- **PW5:** Mitosis
- **PW6:** Meiosis

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

Biologie moléculaire de la cellule James E. Darnell, Harvey Lodish, David Baltimore, Collectif

EAN : 9782744500015, 1997

Biologie moléculaire de la cellule Bruce Alberts, Dennis Bray, Julian Lewis...
[et al.] **EAN** : 9782257152190, 1997

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6. Genetics				
Module Name	Genetics			
Module level	1 st year			
Code	ECUEF132			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Imen BEN ELHADJ ALI			
	Imen BEN ELHADJ ALI			
	Rahma SAID			
	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S1
	Food industry & processing (FIP)	x		
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	30-40 students	
	Workshop	10.5 hrs		
	PW	7 hrs	15-20 students	
Workload	Total	38.5 hrs	Self-study	37 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			
	Not require significant knowledge of genetics			

Module Objectives	- know the cell divisions: Binary division, mitosis and meiosis. - Understand the principles of the genetic change within and among chromosomes. - Understand the differences and the basis of the conjugation and the transduction processes of prokaryotic organisms. - Have the ability to analyze the gene transmission in haploid and diploid eukaryotes; - Identify the extrachromosomal genetic material.
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Learning outcomes	- Differentiate between meiosis and mitosis. - Establish the differences between the inter and intra chromosomal change. - Explain and interpret the results of gene transfer among bacteria. - Carry out an analysis of the gene transmission in haploid and diploid eukaryotes with the statistical analyses. - Describe cytoplasmic genetic material.
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Content	Chapter I : Introduction to genetic - Reminders of mitosis and meiosis - Inter and intrachromosomal change - Concepts of characters, genes, alleles, mutations Chapter II : Genetic analysis of prokaryote - Conjugation - Transduction Chapter III : Genetic analysis of eukaryote - Segregation of heritable characters in haploids. - Segregation of heritable characters in diploids: - Case of 1 pair of alleles - Case of 2 pairs of alleles Chapter IV : Preliminary notions of extrachromosomal genetics Practical work
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- **PW1:** Segregation of heritable characters in haploid organism: Example of *Sordaria macrospora*
 1. Segregation of 1 pair of alleles
 2. Segregation of 2 pairs of alleles
- **TW2:** Segregation of heritable characters in diploid organism: Example of *Drosophila melanogaster*

Tutorials

- **T1:** Mitosis and Meiosis
- **T2:** Bacterial genetics
- **T3:** Genetic analysis of haploids: Case of 1 pair of alleles
- **T4:** Genetic analysis of haploids : Case of 2 pairs of alleles
- **T5:** Genetic analysis of diploids: Case of 1 pair of alleles
- **T6:** Genetic analysis of diploids: Case of 2 pairs of alleles

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

- Génétique : théorie, analyse et ingénierie. Dunod. ISBN 9782100760008.
- Introduction à l'analyse génétique. Anthony Griffiths (6^{ème} édition). ISBN 9782804175580
- Robert P. Levine (1969). Génétique. Université Harvard. Paris, Ediscience. 257p.
- Jean-Michel Petit, Raymond Julien (2007). Mini manuel de génétiqu. Dunod, Paris. ISBN 978-2-10-050657-6.243p.
- Daniel L. Hartl, Elisabeth W. Jones (2003). Génétique : les grands principes. 3^{ème} édition. Dunod, Paris. ISBN 2 10 006735 4. 609p.

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7. Plant biology					
Module Name	Plant Biology				
Module level	1 st year				
Code	UEF141				
Semester(s) in which the module is taught	Semester 1 (S1)				
Person responsible for the module	Fatma TAJINI				
	Fatma TAJINI				
	Mohamed MENDILI				
	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	Food Quality Control (FQC)		x		S1
	Food industry & processing (FIP)		x		
	Type of teaching		Contact hours	Class size	
	Lecture		21hrs	20-40 students	
	Workshop		-	-	
	PW		17.5hrs	10-20 students	
	Total	38.5 hrs	self study	37 hrs	
Credit points	3		Coefficient		1.5
	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams				
Recommended prerequisites	Does not require significant knowledge in plant biology				

Module Objectives	- Understand the broad lines of plant classification and the crucial role of the green lineage in the biosphere. - Know the characteristics of plant cells and the different plant tissues. - Acquire foundational and reinforce knowledge in plant anatomy and morphology. - Master the distinction between structures specific to each organ and each class of Angiosperms. - Recognize the diversity of modes of asexual reproduction in Angiosperms. - Understand the biological cycle of a flowering plant and recognize some families of Angiosperms.
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Learning outcomes	- Manipulate plant organs and identify their specific structures. - Prepare stained histological sections. - Establish a diagnosis based on observation of histological sections. - Highlight the histological diversity of the vegetative apparatus of Angiosperms (primary and secondary structures). - Understand the difference between asexual and sexual reproduction in Angiosperms. - Establish the relationship between flower, fruit, and seed. - Distinguish between different types of seeds and their germination mode.
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Content	I. Introduction: Importance of the plant kingdom in the biosphere II. Overview of the classification and diversity of the plant kingdom A. Thallophytes (Algae, Fungi, Lichens) B. Cormophytes 1. Bryophytes (Mosses) 2. Pteridophytes 3. Spermatophytes i. Gymnosperms (e.g., Pine) ii. Angiosperms (Monocots and Dicots) III. Study of Angiosperms
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- A. Characteristics specific to plant cells
 - B. Plant tissues, particularly primary and secondary meristems
 - C. Vegetative apparatus (stem, leaf, root) and functional adaptations
 - D. Vegetative propagation
 - E. Reproductive apparatus and biology of sexual reproduction

Practical work

- **PW 1.** Plant cell and plant tissues
 - **PW 2.** Vegetative apparatus (morphology)
 - **PW 3.** Vegetative apparatus (anatomy)
 - **PW 4.** Flower and inflorescence: floral biology
 - **PW 5.** Fruits and seeds
 - **PW 6.** Natural and artificial vegetative propagation
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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>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	• Biologie Végétale Structure, fonctionnement, écologie et biotechnologies. Murray NABORS. ISBN : 978-2-76137306-9 • BoutinV., Fogelgesang J-F., Beaux J.-F., Ribola F.(2010) . Atlas de biologie végétale bcpst. Dunod, Paris, ISBN 978-2-10-054506. • BoutinV., L. Geray, Y. Krauss& C. Vilbert (2015). Atlas de biologie bcps, Dunod, Paris. • Savoie., J-M. (2007). Cours de botanique l'appareil végétatif des végétaux supérieurs morphologie et anatomie de la racine, de la tige, et de la feuille. 108p. • • https://www.permatheque.fr/PDF/Cours_de_botanique_l_appareil_vegetatif_des_vegetaux_superieurs.								

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08. Animal Biology

Module Name	Animal Biology			
Module level	1 st year			
Code	ECUEF 142			
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	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	Food Quality Control (FQC)	x		S1
	Food industry & processing (FIP)	x		S1
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	17.5 hrs	10-20 students	
Workload	Total	38.5 hrs	Self-study	37 hrs
Credit points	3		Coefficient	1.5
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of non-attendance = elimination for exams			
Recommended prerequisites				

Module Objectives

- Understand the diversity and evolution of the animal kingdom – Classify major animal groups (Protists, Invertebrates, Vertebrates) and explain their evolutionary relationships.
- Identify the structure, biology, and ecological roles of Protozoa Analyze key species (e.g., Amoeba, Trypanosome, Paramecium) and their medical/ecological significance (e.g., parasitic diseases).
- Compare the anatomy, diversity, and adaptations of invertebrates – Study Sponges, Cnidarians, Worms (Platyhelminthes, Nematodes, Annelids), Mollusks, Arthropods, and Echinoderms, emphasizing their ecological and economic importance.
- Examine vertebrate diversity and biological significance Differentiate between major vertebrate groups (Fish, Amphibians, Reptiles, Birds, Mammals) and discuss their morphological, ecological, and economic roles.
- Develop practical skills in animal biology Perform dissections (e.g., mollusks), microscopic observations (Protozoa), and taxonomic identification of key species (e.g., parasites, arthropods, vertebrates).
- Apply biological concepts to real-world issues – Evaluate the impact of animals in medicine (parasitology), agriculture (pests/beneficial species), and conservation (indicator species, sustainable exploitation).

Intended learning outcomes

- Classify and compare major animal kingdom groups - Distinguish Protists, Invertebrates and Vertebrates using morphological, evolutionary and functional criteria.
- Explain the ecological and medical role of Protozoa - Analyze the biological cycle of parasitic species (e.g., Trypanosoma, Leishmania) and their impact on public health and ecosystems.
- Describe invertebrate anatomy and adaptations - Compare the body plans of Sponges, Cnidarians, Worms, Mollusks and Arthropods, and justify their economic importance (e.g., edible species, bioindicators).
- Characterize vertebrate diversity - Identify distinctive traits of Fish, Amphibians, Reptiles, Birds and Mammals, and relate their adaptations to their ecological niches.
- Master animal biology study techniques - Perform microscopic preparations (Protozoa), dissections (Mollusks) and taxonomic identification keys (Arthropods, Vertebrates).
- Connect theoretical concepts to applied issues - Provide concrete examples of animal applications in medicine (parasite control), agronomy (pest management) and conservation (species protection).

Content

I. Introduction: Diversity of Life

- A. Position of the Animal Kingdom within living organisms
- B. Diversity and evolution of the animal world
- C. Classification principles: systematics and nomenclature

II. Animal-like Protists: Protozoa

- D. General presentation and characteristics (Amoeba, Trypanosome, Paramecium)
- E. Medical importance (diseases, epidemics...) and ecological role (indicator species) of protozoa
- F. Study of biological cycles (focus example: Leishmaniasis)

III. Biology and Diversity of Metazoans

A. Invertebrates

1. Sponges and Cnidarians: body plan - diversity - economic and ecological importance (exploitation and valorization)
2. Worms: Platyhelminthes, Nematodes, Annelids: body plan - diversity - medical importance (parasitic life cycles), ecological and biological significance
3. Mollusks: Classification and Diversity - Ecological and economic importance (edible species: exploitation and valorization)
4. Arthropods:
 - Classification and Diversity
 - Medical, agronomic, ecological, economic importance: beneficial/harmful/venomous species, bioindicators...
5. Echinoderms: general presentation and biological significance

B. Vertebrates

1. Morphological and biological characteristics
2. Diversity (Fish - Amphibians - Reptiles - Birds - Mammals)
3. Biological, ecological and economic importance

PRACTICALS & TUTORIALS

I. Study of Protozoa (Amoeba, Trypanosome, Paramecium) - Sponges and Cnidarians (comparison and identification of Tunisian coastal taxa)

II. Study of Worms

- Compare Trematodes, Cestodes, Nematodes and Annelids
- Identification of main taxa (Liver fluke, Tapeworm, Ascaris, Earthworm...)

III. Study of Mollusks

- Group diversity - Identification of common, edible species...
- Mollusk dissection (snail or mussel)

IV. Study of Arthropods

- Group diversity - Identification: scorpions, myriapods, spiders, ticks, agriculturally significant insects
- Study of locusts and selected insect larvae

V. Study of Vertebrates I: Fish - Amphibians and Reptiles

- Classification: cartilaginous and bony fish
- Classification, diversity and identification of Amphibians: frogs, toads and tadpoles
- Classification and identification of Reptiles: turtles, lizards, colubrids and vipers

VI. Study of Vertebrates II: Birds and Mammals

- Classification, diversity and identification of selected bird species
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- Classification, diversity and identification of selected mammal species

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	▪ Biologie animale - Tome 1 : Des Protozoaires aux Métazoaires épithélioneuriens ; André Beaumont, Pierre Cassier, 15/01/1998 (3eme édition) ▪ Animal Diversity : https://animaldiversity.ummz.umich.edu/								

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09.C2i				
Module Name	C2I			
Module level	1 st year			
Code	UET111			
Semester(s) in which the module is taught	Semester 1			
Person responsible for the module	Rihab Idoudi			
Lecturer	Rihab Idoudi			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)		x	S1
	Food industry & processing (FIP)		x	S1
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Workshop	21hrs	10-20 students	
	Total 21hrs	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	Does not require significant			

Module Objectives	- Develop proficiency in the production, processing, and effective use of text documents and presentations - Enhance productivity, reusability and accessibility through use of basic office tools - acquire knowledge of IT environment - Utilize online communication and collaboration platforms - Production, processing and use of text Documents, presentation with the aim of productivity, reusability and accessibility through office tools (word processing, spreadsheet, presentation) - Knowledge of the fundamental principles of an IT environment. - Use of online communication tools like (e-mails, Classroom, Drive.)
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Learning outcomes	By the end of this module, the students will be able to - Create, format and edit structured documents using word processing and presentation software - Organize and visualize data using basic spreadsheet function and tools - Navigate and operate within a basic IT environment - communicate and collaborate online effectively - Use office tools (word processing, spreadsheet, and presentation). - Use search engines to find information. - Work collaboratively via online tools (emails, Classroom, Drive).
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Content	CHAPTER I : Introduction to computer and internet skills - Presentation of the C2i module - Presentation of online tools (e-mails, Classroom, Drive). CHAPTER II : Fundamental Computer Concepts - File management system: SGF - Absolute and relative paths - Using search functions PW1 : Handling directories/files CHAPTER IV : Office automation – Word processing - Advanced use of word processing software (Microsoft Word) - Formatting documents: fonts, styles, paragraphs - Inserting and manipulating images and graphics - Generating the table of contents - Generation of the table of figures: tables
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PW2: Creation, manipulation and exploitation of text documents

CHAPTER VI: Presentations

- I. Creating professional presentations with Microsoft PowerPoint software
- II. Using presentation templates
- III. Integration of multimedia elements: images, videos, transitions
- IV. Practices for an effective presentation

PW3: : Creation, manipulation and exploitation of presentations

CHAPTER VII: Information acquisition

- I. The Importance of Self-Directed Research in Food Science
- II. Types of Information
- III. Key Research Tools and Platforms for Independent Study
- IV. Best Practices for Independent Research

PW4: Research a chosen food science topic using both scientific and non-scientific sources.

Study and examination requirements and forms of examination	CONTINUOUS MONITORING	
	Written mid-term exam	
	Practical works	100%
	Written final exam	
	Quiz/QCM at the end of each main chapter	
Media employed	Digital presentations, TPs and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	
Reading list	https://www.unilim.fr/scd/ BERTRAND, Claude, et al. DOCUMENT D'ACCOMPAGNEMENT Pour la mise en place du C2i CERTIFICAT INFORMATIQUE ET INTERNET. 2012. https://www.studocu.com/row/document/universite-de-tunis-el-manar/c2i/c2i-niveau-1-notes-de-cours-5/3584764	

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10. English I				
Module Name	English I			
Module level	1 st year			
Code	ECUET112			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Narimen Kamel			
Lecturer	Imen Chebbi			
Language	English			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S1
	Food industry & processing (FIP)	x		S1
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture			
	Workshop		28hrs	20-40 students
	PW			
Workload	Total	28hrs	Self-study	22hrs
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 required prerequisites			

Module Objectives	- Acquire foundational scientific vocabulary relevant to different fields of science and technology. - Develop language skills (reading, writing, listening, and speaking) in scientific contexts. - Understand and use grammatical structures common in scientific communication. - Enhance oral presentation skills tailored to academic and scientific audiences. - Read, comprehend, and analyze scientific texts, and write clearly structured scientific content.
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Learning outcomes	The student will develop the ability to - Identify and use scientific vocabulary, including etymology, prefixes, and suffixes, in oral and written contexts. - Demonstrate correct usage of grammar structures, particularly the Simple Past and Present Perfect, in scientific writing and speech. - Distinguish between major scientific disciplines and articulate their relevance and applications. - Interpret and summarize scientific texts, including articles on materials, energy, and the environment. - Deliver oral presentations on scientific topics using appropriate terminology and structure. - Produce short written texts (e.g., summaries, essays) on science-related themes with coherence, clarity, and technical vocabulary.
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Content	Unit I: What is Science - Getting started in research: Having a career in science - Branches of science - Word formation: dictionary use for scientific purposes - Prefixes and suffixes for scientific use Unit II: Introduction to scientific vocabulary - Etymology of words - Grammar: Simple Past Vs. Present perfect - Materials Science Vs Materials Engineering
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4. Selection of materials
 5. Oral Skills: Speaking in Public for Scientific Purposes

Unit III: Matter

1. Forms of energy
2. Energy efficiencies
3. Work and Power
4. Renewable Energies: Reading Comprehension of Scientific articles + Writing practice

Unit IV: Temperature

1. Changes of temperature state
 2. Pollution and global warming
 3. Plastic pollution
 4. Biodegradable products
-

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written and oral mid-term exam	100%
	Practical works	0%
	Written final exam	0%
	Quiz/QCM at the end of each main chapter	0%

Media employed	Digital presentations, Visit manual and Personal work series are available on ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
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Reading list	▪ Williams, Ivor. English for Science and Engineering. Professional English Series, 2007. ▪ Donovan Peter. Basic English for Science. English Language Oxford University Press, 2008. ▪ Ibbotson, Mark. Professional English in Use: Engineering. Cambridge University Press, 2009.
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 INSTITUT SUPÉRIEUR DE BIOTECHNOLOGIE DE BEJA المعهد العالي للتكنولوجيا ببجاية	Module Handbook Food Industry and Processing (FIP)	ENR-CD-06 06/02/2023
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11. Agri-food law and legislation

Module Name	Agri-food law and legislation			
Module level	1 st year			
Code	EUT113			
Semester(s) in which the module is taught	Semester 1(S1)			
Person responsible for the module	Lobna Essid			
Lecturer	Mohamed Fathallah			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S1
	Food industry & processing (FIP)	x		S1
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture			
	Workshop	14 hrs	10-20 students	
	PW			
Workload	Total	14 hrs	Self-study	37 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, food quality control (or equivalent)			

Module Objectives

- Introduce foundational principles and institutions governing food law
- Familiarize students with legal and regulatory requirements
- Understand legal framework that regulate the international trade of food products
- Encourage critical thinking about implications of food law and trade policies
- Know the Food quality and safety management standards.
- Know the Quality standards in the food industry.
- Know the Processes and unit operations in the food industry
- Identify the main principles of national and international food legislation.
- Analyze regulatory requirements related to food safety and hygiene.
- Interpret and apply rules regarding food labelling and traceability.
- Understand the mechanisms of official control and applicable sanctions.

Learning outcomes

- Describe the roles of institutions and regulatory bodies involved in food safety, labeling and trade
- Explain the basic principles of food law, including traceability
- Recognize the legal requirements for food production, packaging and marketing
- Demonstrate awareness of ethical consideration in food law
- Know the main national and international laws and regulations governing the food sector.
- Identify national, European and international legal texts applicable to food safety, as well as the relevant regulatory institutions.
- Know the mechanisms for resolving disputes between consumers and producers.

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- Explain fundamental principles such as traceability, precaution, operator responsibility, and consumer protection.
 - Analyze the regulatory compliance of a food product based on its labelling.
 - Apply hygiene requirements in an industrial context, in connection with HACCP systems.
 - Evaluate health and legal risks related to regulatory non-compliance.
 - Propose corrective and preventive measures in accordance with regulations in the event of a food safety crisis or product recall.
 - Communicate legal requirements effectively to professionals in the food sector or to non-specialists.

Content

PART I: Foundations of Agri-food law

Preliminary Chapter: The Regulation of Agri-Food Production

- A- The organization of agricultural communes
- B- The contractualization of food production

Chapter I: Free Movement of Food Products

- A. Free movement within the European Union
 - 1- Merchandise and food products
 - 2- Discriminatory taxation of food products
- B. Free movement internationally
 - 1- Regulation of international food trade
 - 2- Free movement and food shortage

CHAPTER II: Regulation of the quality of food products

- A- Product labeling
 - 1- Product classification
 - 2- Designation of origin and geographical indications
 - 3- Certified quality product
- B- Food security
 - 1- Managing food crises
 - 2- Food security control
 - 3- New food challenges (GMO, bioproducts, etc.)

CHAPTER III: Foundations of food legislation

- 1- General remarks and economic context
- 2- Development of community activities in the food sector
- 3- Common Agriculture policy and food legislation
- 4- The common fisheries policy
- 5- Development of the internal market for processed food products
- 6- The industrial policy component
- 7- Consumers, food safety, and health protection

CHAPTER IV: Institutions and regulatory frameworks

- 1- National framework
- 2- European legislation
- 3- Codex Alimentarius and its application
- 4- International harmonization

CHAPTER V: Hygiene, food safety, and traceability

- 1- Hygiene package
- 2- HACCP principles
- 3- Traceability, operators' obligations, and alert management
- 4- Withdrawal and recall procedures

CHAPTER VI: Food labeling

- 1- Allergens, origin, GMOs, use-by dates, nutritional values
- 2- Nutrition and health claims

CHAPTER VII: International trade, food fraud, and legal liability

- 1- International trade: customs requirements and sanitary barriers
 - 2- Definitions: non-compliance, deception, fraud
 - 3- Application of the principle of liability for defective products in the food sector
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- 4- Types of controls and enforcement measures
 - 5- Examples of food safety crises: horse meat, melamine in milk
 - 6- Sanctions and legal procedures
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Study and examination requirements and forms of examination	CONTINUOUS MONITORING	
	The final score is weighted as follows:	
	Written mid-term exam	50%
	Practical works	30%
	Written final exam	0%
	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
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Reading list	▪ Law No. 25 of 2019 dated February 26, 2019, relating to the health safety of foodstuffs and animal feed, The official flagship of the Republic of Tunisia. ▪ Joint food standards program between the Food and Agriculture Organization and the World Health Organization. ▪ Law No. 95 of October 18, 2005 relating to livestock breeding and animal products. ▪ Décret n° 2004-1718 du 2 août 2004 Relatif à l'organisation du contrôle sanitaire des denrées alimentaires. ▪ Arrêté du ministre de la santé publique du 20 juillet 2004 Fixant les modalités d'échantillonnage et d'analyse des produits alimentaires. ▪ Loi n° 2016-54 du 11 juillet 2016 Relative à la sécurité sanitaire des produits alimentaires au niveau des marchés d'exportation (notamment pour les produits bio ou labellisés). ▪ Normes tunisiennes (NT) publiées par l'INNORPI, notamment les normes microbiologiques des denrées alimentaires. ▪ Règlement (CE) n° 178/2002 : principes généraux de la législation alimentaire. ▪ Règlement (UE) n° 1169/2011 : information des consommateurs. ▪ Règlement (CE) n° 852/2004 : hygiène des denrées alimentaires. ▪ Règlement (CE) n° 1924/2006 : allégations nutritionnelles et de santé. ▪ Brun-Bellut, J., & Noël, V. (2019). <i>Sécurité des aliments : De la réglementation aux bonnes pratiques</i>. Lavoisier. ▪ Peyrol, E. (2020). <i>Droit alimentaire – Sécurité sanitaire des aliments et responsabilité des opérateurs</i>. LexisNexis. ▪ Baudouin, J., & Lignon, M. (2018). <i>L'étiquetage alimentaire en pratique</i>. Éditions Tec & Doc. ▪ FAO & OMS – Codex Alimentarius (disponible sur www.fao.org/fao-who-codexalimentarius)
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12. Structural biochemistry				
Module Name	Structural Biochemistry			
Module level	1 st year			
Code	ECUEF211			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Mohamed Raâfet Ben Khedher			
	Mohamed Raâfet Ben Khedher			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	Food Quality Control (FQC)	x		S2
	Food industry & processing (FIP)	x		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	7 hrs		
	PW	14 hrs	10-20 students	
Workload	Total	42 hrs	Self-study	33 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			
Recommended prerequisites	Module ECUEF121 :Organic chemistry.			

Module Objectives	- Identify the constituent units of carbohydrates and their structural assembly to form complex molecules. - Determine the structure and assembly of fatty acids and simple lipids. - Distinguish between the different types of amino acids and their structural assembly to form functional proteins. - Recognize and distinguish the different types of nucleic acids (DNA, RNA) on a structural and physicochemical level.
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Learning outcomes	- Distinguish between monosaccharides, saccharides and polysaccharides and recognize their physicochemical properties. - Determine the structure, nomenclature and classification of fatty acids and identify the differences between simple and complex lipids. - Distinguish between the different classes of amino acids, peptides and proteins as well as their analysis methods. - Determine nucleic acid sequences, identify their structural particularity and determine their role in cellular functioning.
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Content	CHAPTER I: Carbohydrates I. Monosaccharides I.1. Linear structure (Fisher representation) I.2. Cyclic structure (Tollens and Haworth) I.3. Chemical properties I.4. Physical properties II. Osides II.1. Definition and classification II.2. Osidic bond II.3. Main types of disaccharides and trisaccharides, II.4. Main types of polysaccharides II.5. Main types of glycosides CHAPTER II: Lipids
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- I. Fatty acids
 - I.1. Structure and nomenclature
 - I.2. Classification
 - I.3. Physical properties
 - I.4. Chemical properties
 - II. Simple lipids
 - II.1. Glycerides
 - II.2. Steroids
 - II.3. Cerides
 - III. Complex lipids
 - III.1. Glycerophospholipids
 - III.2. Glyceroglycolipids
 - III.3. Sphingolipids

CHAPTER III: Proteins

- I. Amino acids (structure, classification, physical and chemical properties)
- II. Peptides
- III. Proteins (classification, spatial conformation, physicochemical properties, analysis methods)

CHAPTER IV: Nucleic acids

- I. The chemical components of nucleic acids: nitrogenous bases, sugar, phosphate
- II. Nucleosides
- III. Nucleotides
- IV. Polynucleotide: primary structure of nucleic acids
- V. Deoxyribonucleic acid (DNA)
- VI. Ribonucleic acid (RNA)

Practical work

PW1: Carbohydrates

- Identification of unknown carbohydrate solutions
- Colorimetric determination of carbohydrates

PW2: Lipids

- Determination of the molecular weight of triricinolein and the saponification index
- Determination of the degree of unsaturation of triricinolein and the iodine index

PW3: Amino Acids

- Titration of glycine
- Ascending chromatography of amino acids on paper

PW4: Proteins

- Colorimetric protein assay
- Protein electrophoresis on polyacrylamide gel under denaturing conditions

PW5 : DNA

- Extraction of plasmid DNA from bacterial cells.
- Estimation of DNA concentration and purity.

Tutorials

- **TD1:** Bone structure and saccharide binding.
- **TD2:** Classification, nomenclature, systemic name and formulas (crude, semi-developed and developed formula) of fatty acids (FA).
- **TD3:** Acid number, iodine number and chemical oxidation of double bonds of AGs.
- **TD4:** Classification of amino acids
- **TD5:** Structure of nucleic acids

Study and examination requirements and forms of examination

Mixed evaluation
The final score is weighted as follows:

Written mid-term exam	10%
Practical works	0%
Written final exam	90%

Quiz/QCM at the end of each 0%
main chapter

Media employed

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

Reading list

- Structural and metabolic biochemistry 3rd ed. Christian Moussard, 2007. Publisher: DE BOECK. ISBN: 9782804152369.
 - Principles of Biochemistry, 8th ed. David L Nelson and Michael M Cox. 2021. Publisher : W. H. Freeman. ISBN : 978-1319228002.
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13. Physicochemical Analysis Techniques

Module Name	Physicochemical analysis techniques			
Module level	1 st year			
Code	UEF212			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Meriem SMADHI			
Lecturer	Meriem SMADHI			
	Meissa Ouerghi			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	Food Quality Control (FQC)	x		S2
	Food industry & processing (FIP)	x		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	14 hrs	20-40 students	
	Workshop	7 hrs	20-40 students	
	PW	14 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 ECUEF121 : General Chemistry - Module ECUEF122 : Organic chemistry - Module ECUEF112: Physics			

Module Objectives

- Understand the purpose and principle of extraction, preservation, fractionation and centrifugation methods.
- Recognize the different spectroscopic methods (UV-Visible, IR).
- Know the different chromatographic methods (HPLC, GC-MS, TLC).
- Introduce and know the different electrophoretic and isotopic methods.
- Help students to put into practice the physicochemical analysis of samples and to report all the results in a concise and objective manner.

Learning outcomes

- Describe extraction, fractionation and centrifugation methods
- Differentiate between different spectroscopic methods (UV-Visible, IR).
- Classify and identify the different electrophoretic and isotopic methods.
- Carry out a physico-chemical analysis of certain species
- Implement an experimental protocol to characterize a colored species. (UV-visible spectrophotometry method)
- Write a report clearly and concisely.

Content

- CHAPTER I: Extraction, preparation and fractionation methods**
 - Collection
 - Conservation (freezing and freeze-drying)
 - Precipitation, dialysis and filtration
 - Centrifugation and ultracentrifugation
- CHAPTER II: Spectroscopic methods**
 - light spectrum (UV, visible, IR)
 - Colorimetry and spectrophotometry
 - Principle of fluorimetry
- CHAPTER III: Chromatographic methods**
 - Principle of chromatography

- The different types of chromatography
 - **CHAPTER IV: Electrophoretic methods**
 - Principle of electrophoresis
 - The different types of electrophoresis
 - The different methods of revelation
 - **CHAPTER V: Isotopic methods**
 - Principle of the use of radioisotopes
 - Use and measurement of radioactivity
 - Radio-protection
- Practical work**
- **PW1:** Limonene extraction
 - **PW2:** Identification and analysis of infrared spectra of given samples.
 - **PW3:** UV-visible spectrophotometry: Implement an experimental protocol to characterize a colored species

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>5%</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>5%</td></tr> </table>	Written mid-term exam	5%	Practical works	20%	Written final exam	70%	Quiz/QCM at the end of each main chapter	5%
Written mid-term exam	5%								
Practical works	20%								
Written final exam	70%								
Quiz/QCM at the end of each main chapter	5%								
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	▪ Alais S., Francois V (2016). Le cours de chimie générale - 3^{ème} édition de l'abrégé. Ed. Dunod, ISBN : 13-9782100743698, 528 p. ▪ Stéphane P., Béatrice R (2017). Chimie : Ch. Dunod, ISBN 2100748319, 9782100748310, 405 p.								

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14. Molecular biology				
Module Name	Molecular biology			
Module level	1 st year			
Code	ECUEF221			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Mohamed Raâfet Ben Khedher			
Lecturer	Mohamed Raâfet Ben Khedher			
	Awatef Jlassi			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S2
	Food industry & processing (FIP)	x		S2
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21 hrs	20-40 students
	Workshop		10.5 hrs	10-20 students
	PW		7 hrs	10-20 students
Workload	Total	38.5 hrs	Self-study	37 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	- Cell biology - Genetics			

Module Objectives	- Determine the modalities of DNA replication in prokaryotes and eukaryotes. - Identify the mechanisms of protein biosynthesis in prokaryotes and eukaryotes.
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Learning outcomes	- Differentiate the chemical components of nucleic acids: nitrogenous bases, sugar, phosphate. - Analyze nucleic acid sequences, identify their structural particularity and determine their role in cellular functioning. - Determine the molecular components involved in DNA replication. - Determine molecular components implicated in DNA transcription. - Determine molecular components ensuring DNA translation.
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Content	CHAPTER I: Nucleic acids I. The chemical components of nucleic acids: nitrogenous bases, sugar, phosphate II. Nucleosides III. Nucleotides IV. Polynucleotide CHAPTER II: Desoxyribonucleic acid (DNA) I. Structure of DNA (primary, secondary and superior) II. Physicochemical, thermal and spectroscopic properties of nucleic acids III. The DNA of different living beings IV. Conclusion CHAPTER III: Ribonucleic acid (RNA) I. Structure of RNA. II. Properties of RNA.
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III. Different types of RNA (mRNA, tRNA, rRNA)

CHAPTER IV: DNA biosynthesis = Replication

- I. The characteristics of DNA replication
- II. Replication in prokaryotes
- III. Replication in eukaryotes

CHAPTER V: Biosynthesis of RNA = Transcription

- I. Generalities
- II. Transcription in prokaryotes
- III. Transcription in eukaryotes

CHAPTER VI: Protein biosynthesis = Translation

- I. The genetic code (properties and deciphering)
- II. The molecules necessary for translation (mRNA, tRNA, ribosomes)
- III. Mechanism of translation in prokaryotes
- IV. Mechanism of translation in eukaryotes
- V. Mutations

Workshop

- W1: The components of nucleic acids.
- W2: The structure and physicochemical properties of nucleic acids.
- W3: The mechanisms of replication.
- W4: The mechanisms of transcription
- W5: The mechanisms of translation.

Practical work

- PW 1 : Extraction of plasmid DNA
- PW 2: A/ Estimation of the concentration and quality of DNA by spectrophotometry / Thermal denaturation of DNA
- PW 3: Study of DNA quality by electrophoresis on agarose gel
- PW 4: Polymerase chain reaction (PCR)

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	▪ LES ACIDES NUCLEIQUES. Martine BOCCARA et Martine VERDIERE-SAHUQUE. Éditeur : Diderot Editeur Arts Sciences. ISBN : 978-2841340507. ▪ LES ACIDES NUCLEIQUES. Hélène CORDOLIANI. Éditeur : Nathan Université. ISBN : 978-2091906676. ▪ BIOLOGIE MOLECULAIRE. Simon Beaumont 3^{ème} édition. ISBN : 978-2-10-059842-7. ▪ BIOLOGIE CELLULAIRE ET MOLECULAIRE CYTOLOGIE, Stéphane ANDRE, ISBN : 978-2-7298-3729-7

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15. General Microbiology				
Module Name	General microbiology			
Module level	1 st year			
Code	UEF222			
Semester(s) in which the module is taught	Semestre 2 (S2)			
Person responsible for the module	Chedia AOUADHI			
	Chedia AOUADHI			
	Nouha DAKHLI			
	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S2
	Food industry & processing (FIP)	x		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop			
	PW	17.5 hrs	10-20 students	
Workload	Total	38.5 hrs	Self-study	37 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			
Recommended prerequisites	Cell biology			

Module Objectives	- Define microbiology and the concept of microorganisms. - Present the different existing microorganisms. - Know the composition and structure of the bacterial cell. - Manage to identify the main bacterial families. - Know the techniques for studying bacteria. - Have an idea about the field of virology.
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Learning outcomes	The student will be able to: - Present some key stages in the history of microbiology - Present the structure and functioning of bacteria and viruses - Describe the different types of microorganisms and their characteristics - Summarize and analyse the growth characteristics of bacteria - Detection and identify microorganisms
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Content	INTRODUCTION Historical Presentation of the different groups of microorganisms Importance and role of microorganisms CHAPTER I: The bacterial cell Section I: Bacterial morphology Section II: Common and specific constituents CHAPTER II: Techniques for studying bacteria Section I: Culture media, containment and sterilization Section II: Pasteurization and tyndallization CHAPTER III: Study of bacterial growth Section I: Parameters (growth rate and generation time) Section II: Growth factors Section III: Techniques for studying bacterial growth CHAPTER IV: Concept of bacterial systematics
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Section I: Identification of bacteria
Section II: Classification of bacteria

CHAPTER V: The virus

Section I: Definition
Section II: Composition and structure
Section III: Classification
Section IV: Virus cell interaction and viral cycle
Section V: Examples of viruses

Practical work

- PW 1: Preparation and sterilization of culture media
- PW 2: Seeding techniques
- PW 3: Morphological identifications of bacteria
- PW 4: Study of bacterial metabolism
- PW 5: Use of micro-identification methods (Api System)
- PW 6: Bacterial growth in a non-renewed medium
- PW 7: Titration of bacteriophages

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
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Reading list	▪ Baudry S., Brezellek H., (2006). Microbiologie-immunologie : exercices d'application. 4^{ème} Edition. Cahiers du préparateur en pharmacie. France. ▪ Brock T.D. (1970). Biology of Microorganisms. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. ▪ Dedet J.P., (2007). La microbiologie, de ses origines aux maladies émergentes. Préface de Luc Montagnier. Dunod. Paris. ▪ Denis F, Ploy M.C, Martin C, Bengen E, Quentin R. (2011). Bactériologie médicale Techniques usuelles, 2ème édition, , Elsevier Masson SAS, Paris. ▪ Fasquelle R. (1971). Eléments de virologie medicale. Flammarion, Paris. ▪ Frobisher M. (1969). Fundamentals of Microbiology. W. B. Saunders Co., Philadelphia. ▪ Lamanna C., & Mallette F. (1965). Basic Bacteriology. The Williams & Wilkins Co., Baltimore. ▪ Lambin S., & Germain A. (1969). Précis de microbiologie. Masson & Cie, Paris. ▪ Larpent J.P., & Larpent-Gourgau, M. (1970). Microbiologie pratique. Hermann, Paris. ▪ Leclerc H. (1969). Microbiologie. Doin, Deren & Cie, Paris. ▪ Nicklin J, Graeme Cook K, Paget T, Killington R. (2000). L'essentiel en microbiologie. Editions Berti. P : 213-353. ▪ Prescott L.M., Willey J.M., Sherwood L., Woolverton, C.J. & Prescott, L.M. (2013). Microbiologie. De Boeck, 4ème édition. Dunod, Paris.
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16. Plant physiology					
Module Name	Plant Physiology				
Module level	1 st year				
Code	UEF231				
Semester(s) in which the module is taught	Semester 2 (S2)				
Person responsible for the module	Fatma TAJINI				
Lecturer	Fatma TAJINI				
	Mohamed MENDILI				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	Food Quality Control (FQC)		x		S2
	Food industry & processing (FIP)		x		
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		21hrs	20-40 students	
	Workshop		-	-	
	PW		17.5hrs	10-20 students	
Workload	Total		self study	37 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	Plant biology and cell biology				

Module Objectives	- Provide foundational knowledge on the structure and function of plant cells. - Explain the physiological processes involved in plant respiration, fermentation, and fruit development. - Analyze the biochemical composition and characteristics of fruits. - Identify factors affecting fruit degradation and explore preservation techniques. - Develop practical skills in plant growth measurement, germination, and water regulation.	
Learning outcomes	By the end of this course, students will be able to: - Describe the major components of plant cells and explain their physiological roles. - Compare and contrast the processes of respiration and fermentation in plant metabolism. - Explain the mechanisms of fruit development, including pollination, fertilization, and hormonal regulation. - Identify the main types of fruits and analyze their biochemical composition. - Evaluate the causes of fruit degradation and propose appropriate postharvest handling and storage techniques. - Apply laboratory techniques to study germination, growth, transpiration, and dormancy in plants.	

Content	Chapter I: Structure of the Plant Cell Section I: The Cell Wall Section II: The Plasma Membrane Section III: The Cytoplasm Section IV: The Nucleus Chapter II: Respiration and Fermentation Section I: Respiration Section II: Fermentation Chapter III: Fruit Formation Section I: Pollination and Fertilization Section II: Fruit Development and Ripening Section III: Action of Plant Hormones Section IV: Main Types of Fruits Chapter IV: Biochemical Composition of Fruits Section I: Mineral Components Section II: Organic Components Chapter V: Characteristics of Fruits and Their Consequences Section I: Characteristics of Fruits Section II: Causes of Fruit Deterioration Section III: Fruit Protection Techniques Chapter VI: Harvesting and Storage of Fruits Section I: Temperature Effects Section II: Harvesting and Picking Conditions Section III: Fruit Holding in the Storage Room Section IV: Storage Management Section V: Post-Harvest Diseases and Storage Disorders in Certain Fruits Practical and Guided Work • Breaking Dormancy • Germination • Measurement and Expression of Growth • Transpiration	
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	▪ Physiologie végétale, Hpkins, 2^{ème} édition, Serge Ranbour, physio2 V008 :2275-1-3. ▪ Physiologie végétale, 2. Développement, 6^{ème} édition, René Heller, Robert Esnault, Claude Lance, physio2 V003 :2058-7-7. ▪ William G. Hopkins et Norman P.A. Hüner (2009). Introduction to Plant Physiology, 4^{ème} édition, Wiley ed. QK 711.2 H66. ▪ Heller R. (1989). Physiologie végétale.Tome 2. Développement, Ed. Masson.	

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17. Animal Physiology				
Module Name	Animal Physiology			
Module level	2 nd year			
Code	ECUEF 232			
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	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S2
	Food industry & processing (FIP)	x		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	17.5 hrs	10-20 students	
Workload	Total	38.5 hrs	Self-study	37 hrs
Credit points	3	Coefficient	1.5	
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of non-attendance = elimination for exams			
Recommended prerequisites	Module ECUEF 142: Animal Biology (or equivalent)			

Module Objectives	- Master the fundamental principles of general physiology, enabling students to subsequently approach other modules in animal and/or human physiology and physiological regulations. - Understand the key principles of homeostasis and internal environment regulation, including membrane exchanges and interactions between different compartments of the animal organism. - Understand normal and pathological functioning of regulatory systems, particularly those controlled by the nervous and endocrine systems. - Know the organization of the muscular system, along with the cellular and molecular mechanisms of muscle contraction and its energetics. - Understand the physiology of excretory and reproductive functions and their regulatory mechanisms.
Intended learning outcomes	- Understand the fundamental principles of the internal environment: Define and classify the body's fluid compartments, explain their physicochemical properties, and the exchange mechanisms between them. - Master the basics of hematology and the vascular system: Describe the composition and functions of blood, the structure of blood vessels, and the principles of hemodynamics (flow, resistance, pressure). - Analyze homeostasis mechanisms: Explain osmotic and ionic gradients, as well as the regulatory processes that maintain the body's internal balance. - Grasp the organization and physiology of the nervous system: Distinguish between different neural structures, types of neurons, membrane potentials, and neurotransmission mechanisms. - Understand muscle physiology: Describe the structure of muscle fibers, the mechanisms of contraction (electrical, biochemical, and mechanical), and their hormonal and neural regulation. - Apply experimental techniques in physiology: Perform practical manipulations (blood smears, hematocrit measurement, immunophenotyping, study of membrane potentials, and neuromuscular reflexes). - Interpret physiological data: Analyze experimental results (ionic changes, nerve conduction, spinal reflexes) and relate them to theoretical concepts.
Content	Chapter 1: Internal Environment and Homeostasis 1. Body Fluid Compartments

- 1.1. Definition and characteristics of the internal environment
- 1.2. Classification of body fluid compartments
- 1.3. Volume of body fluid components
2. Physicochemical Properties of Fluid Compartments
 - 2.1. Plasma compartment
 - 2.2. Interstitial compartment
 - 2.3. Lymphatic compartment: lymphoid organs and lymphatic circulation
 - 2.4. Intracellular compartment
3. Fluid Exchange Between Compartments
 - 3.1. Osmotic and ionic gradients
 - 3.2. Homeostatic mechanisms

Chapter 2: Blood and the Vascular System

1. Hematology
 - 1.1. Study of blood cells; organic and ionic composition of blood; hematopoiesis, erythropoiesis, and regulatory factors
 - 1.2. Functions of blood: Structure and function of hemoglobin, gas transport in blood, and acid-base balance
2. Structure and Characteristics of Blood Vessels
 - 2.1. Structure of arterial, venous, and microcirculatory capillary walls
 - 2.2. Concepts of blood flow, resistance, and blood pressure: Definitions; effects of blood viscosity, vessel length, and diameter

Chapter 3: Neural Physiology

1. Anatomy of the Nervous System: Structural and functional organization of the central and peripheral nervous systems
2. Neuron Physiology: Classification, excitability, and functions
3. Nerve Physiology: Classification, excitability, modes, and speed of nerve impulse conduction
4. Autonomic Nervous System: Somatic, enteric, and autonomic nervous systems, structure of efferent pathways, autonomic ganglia, pharmacology of pre- and post-ganglionic neurons
5. Membrane Potentials: Resting potential, electrotonic potentials, and action potential
6. Synapses: Electrical, chemical, and gas-mediated (NO) synapses
7. Neurotransmission: Chemical messengers, roles, and mechanisms of action
8. Integration of Electrical Signals and Neural Circuits

Chapter 4: Structure and Physiology of Muscle Fibers

1. Muscle Cells: Structural organization, common features, and classification (smooth muscle, striated muscle, and cardiac muscle) Skeletal Muscle
2. Striated muscle fibers (glycolytic fibers, oxidative fibers), connective tissue in skeletal muscle, and satellite cells
 - Electrical, biochemical, and mechanical activity of muscle contraction
 - Energy metabolism in skeletal muscle
 - Mechanics of muscle fiber contraction
 - Neuromuscular junction (motor endplate): Motor unit concept, electromechanical coupling
 - Regulation of muscle contraction: Cross-bridge activation, calcium sources, and ATP roles. Hormonal and local factor influences.
3. Control and Spinal Reflexes
 - 3.1. Innervation of skeletal muscle: α , γ , and β motor neurons
 - 3.2. Exteroceptive, proprioceptive, and interoceptive reflexes

Practical Sessions

Session 1 (Lab): Blood smear, blood volume measurement, and haematocrits determination in rats

Session 2 (Lab): Blood group immunophenotyping (ABO and Rh systems) and study of cell permeability

Session 3 (Lab/Tutorial): Study of membrane potential changes based on extracellular ion concentrations

Session 4 (Lab): Study of a nerve-muscle preparation in rodents: Neural control of

muscle activity and synaptic transmission

Session 5 (Lab and/or Tutorial): Study of reflex and integrative actions of the spinal cord (spinal reflexes)

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	▪ Human Physiology, Lauralee Sherwood, 3rd edition - June 2015 - 746 pages - ISBN 978-2-8041-8996-9 ▪ Hematology, Succeeding in the EDN (National Dental Exams), 5th Edition; French Society of Hematology, ISBN: 9782294782800 EISBN: 9782294783531 Language(s): French ▪ Neuroscience, Dale Purves, George J. Augustine, David Fitzpatrick, William C. Hall, Anthony-Samuel LaMantia, Leonard E. White, 6th edition - June 2019 - 960 pages - ISBN 978-2-8073-1492-4 ▪ Physiology of Striated Muscle; J.-D. Ginet and J.-B. Le Martret; Revue d'Orthopédie Dento-Faciale: Volume 7, Issue 3, July 1973 (405–415), DOI: https://doi.org/10.1051/odf/1973027	

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18. Biotechnology basics				
Module Name	Biotechnology basics			
Module level	1 st year			
Code	UEO211			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Mohamed ALLOUCHE			
Lecturer	Mohamed ALLOUCHE			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)		x	S2
	Food industry & processing (FIP)		x	S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	7 hrs	20-40 students	
	PW			
Workload	Total	28 hrs	self study	47 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	Genetics, Cell biology			

Module Objectives	- Introduce biotechnology and its various categories - Introduce transgenesis - Understand the applications of biotechnology in industry - Identify and understand the limitations and risks associated with the use of biotechnology
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Learning outcomes	- Differentiate the various types of biotechnology - Describe the different techniques of transgenesis - Understand the applications and limitations of transgenesis - Describe the methods of genetic transformation in animals and plants - Describe its use in industry - Understand the health and environmental risks of biotechnology
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Content	Introduction Definition - Historical Overview Transgenesis and Its Applications Definition - Heterologous and Homologous Recombination Techniques of Transgenesis Gene Addition Applications Limitations and Risks Applications of Biotechnology in Industry Genetic Transformation of Animals Genetic Transformation of Plants Environment and Biodiversity Biofuels and Bioenergy Applications in the Food Industry Limitations and Risks of Biotechnology Human Health Risks
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Environmental Risks
Economic Risks

Tutorials:

- **TD1:** Transgenesis (MCQs + Application Exercises): Interest; techniques used; limitations and risks.
- **TD2:** Genetic Transformations (MCQs + Application Exercises): Usefulness in industry; advantages; disadvantages; risks to biodiversity.
- **TD3:** Biotechnology Risks (MCQs + Application Exercises): Identifying health, environmental, and economic risks.

Study and examination requirements
and forms of examination

Continuous monitoring
The final score is weighted as follows:

Written mid-term exam	100%
Quiz/QCM at the end of each main chapter	0%

Media employed

The course materials are available on the ISBB website : <https://isbb.rnu.tn/>

Reading list

- <http://www.inrp.fr/Acces/biotic/biomol/enjeux/appligen/html/modeles.htm>
 - <http://www.snv.jussieu.fr/vie/dossiers/transgenese/agrobacterium/agro.htm#bacterie>
 - <https://www.studocu.com/fr/document/universite-paris-saclay/biologie-cellulaire/cours-introduction-aux-biotechnologies-l2-biotechnologie/34459770>
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18. Sustainability and Climate Change

Module Name	Sustainability and Climate Change			
Module level	1 st year			
Code	UEO211			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Hela KCHAOU			
Lecturer	Hela KCHAOU			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	Food Quality Control (FQC)		x	S2
	Food industry & processing (FIP)		x	S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	7 hrs	20-40 students	
	PW			
Workload	Total	28 hrs	self study	47 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 Objectives

- Understand the scientific, economic, and social dimensions of climate change impacts on food systems.
- Analyze sustainability challenges in agri-food production, processing, and distribution.
- Apply international sustainability frameworks (e.g., SDGs, ISO 14001) to real-world food industry scenarios.
- Develop critical thinking skills to propose climate-resilient solutions for the Tunisian context.

Learning outcomes

- Explain the interplay between climate change and food security.
- Evaluate the carbon footprint of food supply chains using LCA principles.
- Discuss waste-reduction strategies aligned with circular economy models.
- Debate policy interventions for sustainable agriculture in Tunisia.
- Propose mitigation/adaptation measures for local agri-food business.

Content

Lectures:

- Introduction to sustainability in food systems
- Climate science basics
- Sustainable food production
- Policy and standards
- Circular economy in agri-food
- Climate risk assessment
- Innovation and future trends

Workshops

- carbon footprint calculation: simulate emissions for a local tomato processing plant
- sustainability audit role-play: teams evaluate mock agro-industrial facilities using iso 14001 criteria
- policy debate

Study and examination requirements and forms of examination	Continuous monitoring The final score is weighted as follows: <table> <tr> <td>Written mid-term exam</td><td>80%</td></tr> <tr> <td>Presentations</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	80%	Presentations	20%	Quiz/QCM at the end of each main chapter	0%
Written mid-term exam	80%						
Presentations	20%						
Quiz/QCM at the end of each main chapter	0%						
Media employed	The course materials are available on the ISBB website : https://isbb.rnu.tn/						
Reading list	Veena Soni (2024). Changement climatique et durabilité des ressources, Editions Notre Savoir, ISBN-13 : 978-6207610266						

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19. Chemical contaminants in food

Module Name	Chemical contaminants in food			
Module level	1st year			
Code	UEO212			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Meriem SMADHI			
Lecturer	Meriem SMADHI			
	Ghofrane Charada			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)		x	S2
	Food industry & processing (FIP)		x	S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	7 hrs	20-40 students	
	PW	14 hrs	10-20 students	
Workload	Total	42 hrs	Self-study	33 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 ECUEF121 : General Chemistry - Module ECUEF122 : Organic chemistry			

Module Objectives

- Recognize and introduce chemical contaminants in food (types, sources and standards).
- Recognize dioxins and PCB.
- Recognize heavy metals (lead, cadmium and mercury).
- Classify and identify pesticides.
- Recognize the risks associated with chemical contamination of food.
- Help students put chemical contaminant analysis of food into practice and report all results in a concise and objective manner.

Learning outcomes

- Classify pesticides, assess the risk and dosing means of measuring residues.
- Establish the risks linked to chemical contamination of food.
- Carry out an experimental analysis of certain chemical contaminants in food.
- Write a report clearly and concisely.

Content

CHAPTER I: Generalities

- Different types: natural or of anthropogenic origin
- Presence environmental presence
- Sources of contributions
- Standards: WHO tolerable daily intake

CHAPTER II: Dioxins

- Definition
- Chemical groups

- Origin
 - Destruction
 - Human exposure to dioxins and consequences
 - **CHAPTER III: PCBs (polychlorinated biphenyls)**
 - Definition
 - Danger for humans and the environment
 - Problem and solutions
 - **CHAPTER IV: Heavy metals: lead, cadmium and mercury**
 - Introduction
 - Estimation of dietary intake of lead, cadmium and mercury
 - Risks linked to lead contamination of food
 - Risks linked to food contamination by cadmium
 - Risks linked to food contamination by mercury
 - **CHAPTER V: Pesticides**
 - Definition and main families
 - Organophosphates OP and organochlorines OC in agri-food products • Definitions
 - Residues of OP and OC in agri-food products
 - Harmful effects of OP and OC
 - Risk assessment and means of control
 - Dosage of residues in food derivatives
- Practical work**
- **PW1:** Dosage of sulphites in dried fruits
 - **PW2:** Determination of nitrite ions in sausages
 - **PW3:** Dosage of nitrite ions in water

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>70%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>10%</td></tr> </table>	Written mid-term exam	70%	Practical works	20%	Quiz/QCM at the end of each main chapter	10%
Written mid-term exam	70%						
Practical works	20%						
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						
Reading list	▪ Food Standards of Codex Alimentarius, https://www.fao.org/fao-who-codexalimentarius/home/fr/ ▪ FAO : Food and Agriculture Organization of the United, https://www.fao.org/home/fr/ ▪ WHO : World Health Organization, https://www.who.int/fr/ ▪ ANCSEP : National Agency for Health and Environmental Product Control, http://www.ancsep.rns.tn						

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20. General economics				
Module Name	General Economics			
Module level	1 st year			
Code	UET211			
Semester(s) in which the module is taught	Semester 2 (S2)			
Person responsible for the module	Lobna ESSID			
Lecturer	Amira GHOZZI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S2
	Food industry & processing (FIP)	x		S2
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21hrs	20-40 students
	Workshop			
	PW			
Workload	Total	21 hrs	Self-study	55 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	▪ Does not require significant knowledge of economics			

Module Objectives	- Discover the concepts of economic science. - Distinguish the main currents of economic thought. - Discuss the different relationships between economic agents. - Understand the concept of economic circuit.
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Learning outcomes	- Identify the different economic agents. - Learn the different types of economic relationships. - Represent a simplified economic circuit between different economic agents.
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Content	Introduction Introduction to economics (resource scarcity, choice, and rationality). Branches of economics (Micro and Macroeconomics). The scientific approach in economics. Chapter I: Microeconomics Introduction: Market mechanisms Section I: Demand, supply, and price. Section II: Market equilibrium and price formation. Section III: Government intervention (Taxation, subsidies, price floors, price ceilings). Chapter II: Consumer Behavior Introduction: Consumer rationality Section I: The theory of utility and preferences. Section II: The effect of income variations on consumption (Engel's Law). Section III: The effect of price variations on consumption (Elasticities). Chapter III: Production Function and Costs Introduction: Production theory Section I: Short-term production and the concept of productivity. Section II: Producer equilibrium and the search for optimal combinations.
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Section III: The impact of costs on supply, different categories of costs.

Chapter IV: Macroeconomics

Section I: Households.

Section II: Macroeconomic aggregates.

Chapter V: Basics of Agrifood Economics

Section I: Food and consumption (Food consumption models).

Section II: Analysis of agri-food systems and supply chains.

Section III: Strategies of agri-food companies.

Chapter VI: Agrifood Marketing and Commercialization

Key marketing concepts.

Sales techniques.

Marketing Plan (Product – Price – Promotion – Place).

Market research (Case studies).

**Study and examination
requirements and forms
of examination**

CONTINUOUS MONITORING

The final score is weighted as follows:

Written mid-term exam 1	50%
Written mid-term exam 2	50%
Quiz/QCM at the end of each main chapter	0%

Media employed

Course material

Reading list

- Frédéric Poulon “General economics”, Dunod 2015.
 - I.Abdeljaoued, L.Bouzaiane, A.Bsaïs, “Introduction to the economy”, CPU, 1999.
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21. Management				
Module Name	Management			
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	Amira GHOZZI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	X		S2
	Food industry & processing (FIP)	X		S2
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21hrs	20-40 students	
	Workshop	7hrs	20-40 students	
	PW			
Workload	Total	28 hrs	Self-study	47 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	Does not require significant knowledge of management			

Module Objectives	- Discover concepts related to management. - Distinguish the different worlds of a decision-making process. - Understand the interactions between a company and its environment - Identify the stages of the decision-making process.
Learning outcomes	- Identify the different economic agents. - Learn the different types of economic relationships. - Represents a simplified economic circuit between different economic agents.

Content	Introduction: The Content of the Concept Definition and purpose of management The management process: Planning / Organizing / Directing / Controlling The different aspects and tools of management The manager and decision making Chapter I: The Business Introduction: Definition of a business / Classification / Forms and structure Section I: The different functions of the business (Commercial / Technical / Management / Administrative) Section II: Relationship with other economic agents and the market Section III: Components of the business environment Chapter II: Agri-Food Strategies Introduction: Tools and methods of strategic analysis Section I: Agri-food strategies Section II: Value chain and competitive advantage Section III: Differentiation and innovation strategies
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Chapter III: Production and Inventory Management

Introduction: Production function and costs

Section I: Cost of production, variable costs, fixed costs, intermediate management balances

Section II: Inventory management, different types of inventories, costs related to inventory

Section III: Forecasting management

Quality management

Human Resources Management (Motivation)

Study and examination requirements and forms of examination

CONTINUOUS MONITORING

The final score is weighted as follows:

Written mid-term exam 1	50%
Written mid-term exam 2	50%
Written final exam	00%
Quiz/QCM at the end of each main chapter	00%

Media employed

Course material

Reading list

- "The Reinvented Company" published by ORGANIZATION, 1995.
 - "Organization and Management of the Company" NATHAN edition, 2000.
 - "Economy and Business Management" C.BUSSENAULT and M.PRETET edition VUIBERT, 1995.
 - "Strategic Business Management" M. COTE, G.MORIN edition, 1995.
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22. Food biochemistry				
Module Name	Food Biochemistry			
Module level	2 nd year			
Code	UEF311			
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
	Food Quality Control (FQC)	x		S3
	Food industry & processing (FIP)	x		S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshops			
	PW	14 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	65 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	▪ Structural biochemistry (or equivalent)			

Module Objectives	- Understand the properties of proteins, lipids and polysaccharides and their roles in foods; - Know the micronutrients in a food product; - Identify the different classes of foods; - Understand the concept of food additives and identify the main classes.
Learning outcomes	The student will be able to: - Distinguish the roles and functional properties of different types of macronutrients (proteins, polysaccharides and lipids) in foods; - Differentiate between enzymatic and non-enzymatic browning reactions and their role in food quality; - Differentiate and identify the roles of vitamins, pigments and minerals in foods; - Classify and identify the properties of the main foods; - Classify food additives and explain their roles in food conservation. - Apply laboratory techniques to analyze composition and physico-chemical properties of foods. - Be able to work independently and in a team to analyse and produce scientific reports.
Content	CHAPTER I: Macromolecule composition of food products I. General information on different foods II. The main dietary carbohydrates and derived products (structure and functional properties) III. The main dietary lipids 1- Functional properties 2- Lipid oxidation: mechanisms and control strategies IV. Dietary proteins 1- Structure 2- Functional properties 3- Enzymatic and non-enzymatic browning reactions: causes and affecting factors CHAPTER II: Microelements in food products I. Food vitamins 1- The different classes 2- Stability 3- Uses and roles

- II. Pigments: importance and stability in food
- III. Minerals : sources and their impact on food quality
- CHAPTER III: General composition and properties of the main foods**
- 1- Cereals and derivatives
 - 2- Milk and dairy products
 - 3- Meat products
 - 4- Eggs and egg products
 - 5- Fatty substances
 - 6- Fruits, juices and fermented drinks
- CHAPTER IV: Food additives**
- 1- Color dyes
 - 2- Conservatives
 - 3- Antioxidants
 - 4- Texture agents

Practical work

- **PW1:** Extraction of casein from milk and determination of its pHi – Effect of pH on solubility.
- **PW2:** Determination of reducing sugars in commercial juices.
- **PW3:** Determination of the functional properties (foaming and emulsifying) of gelatin and gum arabic.
- **PW4:** Determination of the oxidative stability of seed oil.
- **PW5:** Dosage of vitamin C in fruit juice.
- **PW6:** Extraction and dosage of phenolic compounds from a plant matrix.

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>7%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td>Written final exam</td><td>70%</td></tr> <tr> <td>Flipped classroom teaching method</td><td>3%</td></tr> </table>	Written mid-term exam	7%	Practical works	20%	Written final exam	70%	Flipped classroom teaching method	3%
Written mid-term exam	7%								
Practical works	20%								
Written final exam	70%								
Flipped classroom teaching method	3%								
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	▪ SCIENCE DES ALIMENTS, Volume 1 : Stabilisation biologique et physico-chimique (Biochimie • Microbiologie • Procédés • Produits). Lavoisier 2006, ISBN 2-7430-0833-4 ▪ SCIENCE DES ALIMENTS, Volume 2 : Technologie des produits alimentaires (Biochimie • Microbiologie • Procédés • Produits). Lavoisier 2007, ISBN 2-7430-0888-8 ▪ BIOCHIMIE ALIMENTAIRE - 6ème édition de l'abrégé. Dunod 2008, ISBN: 987-2-10-051930-9								

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23. Enzymology				
Module Name	Enzymology			
Module level	2 nd year			
Code	ECUEF312			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Mohamed Raâfet Ben Khedher			
Lecturer	Mohamed Raâfet Ben Khedher			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S3
	Food industry & processing (FIP)	x		S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	07 hrs	20-40 students	
	PW	14 hrs	10-20 students	
Workload	Total	38 hrs	Self-study	33 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 ECUEF211 : Structural biochemistry (or equivalent)			

Module Objectives	- Introduce basic concepts of enzymology. - Learn the characteristics of enzymatic catalysis. - Understand the reaction diagram of an enzymatic reaction and know how to determine its kinetic components. - Learn about the effectors of enzymatic reactions. - Recognize the properties and applications of industrial enzymes.
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Learning outcomes	- Master the structure, classification and nomenclature of enzymes. - Distinguish between the key properties of enzymes (efficiency, specificity and modularity) and establish the link between the geometric and electronic complementarity of the enzyme/substrate interaction. - Identify the phases of the enzymatic reaction and know how to deduce the mathematical equations and graphic representations of the kinetic parameters. - Distinguish between modes of inhibition (competitive, non-competitive and uncompetitive) and their effect on enzyme kinetics. - Know the industrial potential of certain enzymes and the extent of their field of application.
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Content	CHAPTER I: General introduction - Historical background - Definitions CHAPTER II : Enzymatic catalysis - The elements of the enzymatic reaction (cofactor, substrate, product) - Structure of enzymes - Classification of enzymes - Enzyme nomenclature - The properties of enzymes (efficiency, specificity and modularity) - Transition state and activation energy - Concept of active site - Influence of some effectors on enzymatic activity CHAPTER III : Enzymatic kinetics - Definitions and experimental conditions
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- II. Principle of chemical kinetics
- III. Order of chemical reactions
- IV. The phases of the enzymatic reaction
- V. Michaëlis –Menten model
- VI. Graphical determination of kinetic parameters Vmax, KM

CHAPTER IV : Enzymatic reaction effectors

- I. The different types of effectors
- II. Definition and general characteristics of inhibitors
- III. Reversible inhibitors (competitive, non-competitive, incompetitive, mixed)
- IV. Influence of temperature and pH

CHAPTER V : Industrial enzymes

- I. Obtaining enzymes (fermentation, extraction, purification)
- II. Immobilization of enzymes
- III. Industrial application of enzymes (fermentation, extraction, purification)

Practical work

- **PW 1:** Extraction of invertase from baker's yeast
- **PW 2:** Measurement of invertase activity as a function of time
- **PW 3:** Influence of temperature and pH on invertase activity
- **PW 4:** Determination of optimal conditions for enzymatic activity

Tutorials

- **T1:** Nomenclatures and enzymatic reactions
- **T2:** Properties of enzymes: specificity and chemical hydrolysis
- **T3:** Experimental conditions and enzymatic kinetics
- **T4:** Enzymatic effectors

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>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	▪ ENZYMOLOGIE FONDAMENTALE. Emmanuel JASPARD. Éditeur : ELLIPSES. ISBN : 978-2340035157. ▪ PRINCIPES D'ENZYMOLOGIE. Shripad PANDHARIKAR. Editions Notre Savoir. ISBN : 978-6205345955.								

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24. Food microbiology					
Module Name	Food microbiology				
Module level	2 nd year				
Code	ECUEF321				
Semester(s) in which the module is taught	Semester 3 (S3)				
Person responsible for the module	Sana M’HIR				
Lecturer	Sana M’HIR				
	Mouna MAHJOUBI				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	Food Quality Control (FQC)		x		S3
	Food industry & processing (FIP)		x		S3
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		21 hrs	20-40 students	
	Workshop				
	PW		21 hrs	10-20 students	
Workload	Total		42 hrs	Self-study	60 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	Module UEF222: General microbiology (or equivalent)				

Module Objectives	Upholds methods for identifying microorganisms and the main microbial groups that are involved in the agricultural industry, whether as a health risk, an alteration agent, a fermentation agent, a probiotic, or some other technological use.
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Learning outcomes	- Gain knowledge of the microbiological aspect of food transformation - Being aware of the frequency of microbiological incidents - Ensuring consumer health and the manufacturing quality of hygiene - Knowing aware of the microbiological groups involved in food spoilage - Gain knowledge of food microbiological to analyse and identify microorganisms in foods - Apply microbiological criteria to ensure the quality and safety of food products
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Content	Part 1: Food Microbiology CHAPTER I: Microbiology of the principal food products - Water Microbiology - Milk Microbiology - Fermented milks and cheeses Microbiology - Butter and grass-based materials Microbiology - Meat and meat's products Microbiology - Fish and aquatic products Microbiology - Beverages Microbiology - Microbiology of plant and plant-based products - Microbiology of canned goods
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- Microbiology of various products (frozen, dehydrated, ready meals)

Part 2: Control of food products

CHAPTER I: Objectives of microbiological control

- Hygienic quality
- Technological quality
- Levels of control

CHAPTER II: Microbiological analyses of Food

- Analysis methods in food microbiology
- Microscopic analysis
- Quantitative analysis
- Qualitative analysis and investigation into pathogens microbes
- Additional analysis
- Interpretation of results

Practical work

- **PW1:** Microbiological analysis of Water
- **PW2:** Microbiological analysis of milk
- **PW3:** Microbiological analysis of cheese
- **PW4:** Microbiological analysis of meat and meat products
- **PW5:** Microbiological analysis of cheese
- **PW6:** Microbiological analysis of canned foods
- **PW:** visit a Company or a food analysis laboratory/ Hygiene services laboratory in Béja

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	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	▪ 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	

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25. Process engineering

Module Name	Process Engineering			
Module level	2 nd year			
Code	UEF322			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Fatma Bouaziz			
Lecturer	Fatma Bouaziz			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	Food Quality Control (FQC)	x		S3
	Food industry & processing (FIP)	x		S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	7 hrs	20-40 students	
	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	- UEF110: Mathematics/Physics - UEF120: Chemistry			

Module Objectives	- Give students scientific and technological knowledge on the design, sizing and operation of pilot or industrial units for the transformation of matter and energy - Understand the basics of fluid mechanics - Study fluids at rest (Fluid Statics) and in motion (fluid dynamics) - Know the three modes of heat transfer and establish energy conservation balances - Know the transfer of matter by diffusion and convection
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Learning outcomes	The student will be able to: - Calculate the physical characteristics of fluids (viscosity, density) - Apply the fundamental fluid statics laws to calculate pressures. - Apply the fundamental fluid dynamics laws to calculate flow rates, rates, pressures and pressure losses. - Calculate thermal heat fluxes and thermal conductivity of certain materials. - Determine the diffusion coefficient in the case of material transfer
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Content	CHAPTER I: Transfer of momentum or fluid mechanics I. Deformation of a fluid II. Hydrostatic (fluid at rest) III. Application: Pressure gauges IV. Hydrodynamics (fluid in motion) - Fundamental equations - Load losses CHAPTER II: Heat transfer I. Different modes of heat transfer - Heat transfer by conduction - Heat transfer by convection - Heat transfer by radiation II. Energy conservation assessments Unidirectional conduction in steady state: Example of a composite wall - Rectangular coordinates - Cylindrical coordinates CHAPTER III: mass transfer I. Transfer of mass by diffusion - Molecular diffusion in liquid media
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- Estimation of the diffusion coefficient
 - Diffusion in solid media
- II. mass transfer by convection
- III. mass balances

Practical work

- **PW1:** Industrial visit to Rayen Food industry
- **PW2:** Fluid dynamics and heat transfer in the process engineering laboratories at ISSBAT (higher institute of applied biological sciences in Tunis)

Tutorials

- T1: Physical characteristics of a fluid
- T2: Fluid Statics
- T3: Mechanics of perfect and real fluids
- T4: Heat transfer
- T5: Material transfer

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>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	▪ Génie des procédés alimentaires - Jean-Jacques Bimbenet , Albert Duquenoy, Gilles Trystram ; 2eme édition 574 pages, ISBN13 : 978-2-10-050470-1								

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26. Applied Nutrition					
Module Name	Applied Nutrition				
Module level	2 nd year				
Code	UEF331				
Semester(s) in which the module is taught	Semester 3 (S3)				
Person responsible for the module	Dhouha ALIM				
Lecturer	Dhouha ALIM				
	YOSRA MESSOUDI				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	Food Quality Control (FQC)		x		S3
	Food industry & processing (FIP)		x		S3
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		14 hrs	10-20 students	
	Workshop		7 hrs	10-20 students	
	Project		7 hrs	10-20 students	
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					

Module Objectives	- Classify foods according to their origin, composition, and nutritional functions, using recognized classification systems. - Understand the links between diet and health, by identifying pathologies linked to nutritional imbalances. - Identify the roles and indications of food supplements and substitutes, in a clinical or preventive context. - Analyze the impact of technological processes (cooking, preservation, industrial processing) on the nutritional quality and bioavailability of nutrients. - Interpret malnutrition situations (deficiency or excess) and propose appropriate nutritional strategies.
Intended learning outcomes	- Classify foods according to their origin, composition, and nutritional function. - Explain the links between diet and nutritional pathologies (deficiencies, excesses, metabolic diseases). - Identify and distinguish between food supplements, substitutes, and their indications. - Evaluate the impact of technological processes on nutritional composition and nutrient bioavailability. - Recognize the different forms of malnutrition and propose appropriate nutritional approaches. - Critically analyze food products on the market, including nutrition claims and labels.
Content	CHAPTER I: Food Classification - Basics of Food Classification - Nutritional Composition of Foods - Advanced Classification System CHAPTER II: Nutrition and Diseases - Nutrition-Related Diseases - Metabolic Diseases (Obesity, Diabetes) - Deficiencies: Iron, Iodine, Zinc, and Vitamins - Overeating and Cardiovascular Diseases - Food Supplements and Substitutes - Supplements: Vitamins, Minerals, Proteins, Essential Fatty Acids - Substitutes: Specialty Milks, Reconstituted Meals, Protein Powders

3. Indications, Precautions, and Limitations
- III. Malnutrition and Nutritional Status
 1. Protein-Energy Malnutrition (Marasmus, Kwashiorkor)
 2. Overweight and Obesity
- IV. Influence of Technological Processes on Nutritional Value
 1. Effects of Cooking (Boiling, Steaming, Frying, Microwaving, etc.)
 2. Impact of Industrial Processing (Refining, Preserving, Sterilizing)
 3. Bioavailability of Nutrients after Technological Processing

- **PW1:** In vitro digestion of food
- **PW2:** In vitro determination of the glycemic index of different foods.
- **PW3:** Development and evaluation of a balanced diet plan according to a specific nutritional profile."

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>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	▪ Jeantet R., Croguennec T., Schuck P., Brulé G. (2006). Science des aliments, Volume 1 : Stabilisation biologique et physico-chimique (Biochimie • Microbiologie • Procédés • Produits). Ed. Lavoisier, ISBN 2-7430-0833-4, 381p. ▪ Jeantet R., Croguennec T., Schuck P., Brulé G. (2007). Science des aliments, Volume 2 : Technologie des produits alimentaires (Biochimie • Microbiologie • Procédés • Produits). Ed. Lavoisier, ISBN 2-7430-0888-8, 456p. ▪ Alais C., Linden G., Miclo L. (2008). Biochimie alimentaire - 6^{ème} édition de l'abrégé. Ed. Dunod, ISBN: 978-2100519309, 272p.								

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27. Toxicology				
Module Name	Toxicology			
Module level	2 nd year			
Code	UEF 332			
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	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S3
	Food industry & processing (FIP)	x		S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	14 hrs	20-40 students	
	Workshop			
	PW	07 hrs	10-20 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	- Module ECUEF131 : Cell biology (or equivalent) - Module ECUEF211 : Structural biochemistry (or equivalent) - Module ECUEF211 : General microbiology (or equivalent) - Module ECUFE221 : Molecular biology (or equivalent)			

Module Objectives	- Acquire knowledge about toxicity and the fate of toxic substances in the organism. - Define mechanisms of action of toxicants on the organism. - Know the toxicological parameters during the assessment of toxicity. - Explain the toxicological risks associated with food by studying their origins and effects and control measures.
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Learning outcomes	The student will be able to: - Understand toxicology based on different sources of contamination. - Evaluate the severity of the toxic effect related to the dose. - Know the consequences of food contamination by toxic substances on health - Know how to intervene to avoid or reduce toxicity
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Content	Chapter 1: Basic notions of Toxicology - Generality - The fate of toxic substances - Assessment of Toxicity: the different doses and their effects - Dose/time and dose/effect relationships - Toxicokinetics and Toxicodynamics Chapter 2: Food toxicology - The mechanisms of action of a toxicant - Cytotoxicity - Genotoxicity Chapter 3. Food contaminants
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1. Contamination of microbial and parasitic origin of food

- 1.1. Collective food poisoning
- 1.2. Listeriosis
- 1.3. Salmonellosis
- 1.4. Parasitoses
- 1.5. Diseases caused by unconventional agents

2. Contaminations of fungal origin

- 2.1. Mycotoxins in animal and human food
- 2.2. Phycotoxins in fish products
- 2.3. Cyanotoxins in drinking water

3. Contamination of anthropogenic origin

- 3.1. Nitrites and nitrates
- 3.2. Toxic heavy metals
- 3.3. Pesticides
- 3.4. Antibiotic and hormonal residues...
- 3.5. Food additives and processing aids

Chapter 4. Hygiene and food safety

Practical work

PW1: Search for mycotoxins in cereals

PW2: Determination of nitrates and nitrites in drinking water

PW3: Visit to toxicology units in laboratories

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

- 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.
- Toxicologie de Xavier Coumoul et al.2017. Editeur DUNOD

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28. Food science				
Module Name	Food science			
Module level	2 nd year			
Code	UEF333			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	-			
Lecturer	Faten BEN AMOR			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S3
	Food industry & processing (FIP)	x		S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	14 hrs	20-40 students	
	Workshop			
	PW	14 hrs	10-20 students	
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	- Biochemistry (or equivalent) - General Microbiology (or equivalent) - Physico-chemical analysis			

Module Objectives	- Identify the nutritional needs and quality of food. - Evaluate the microbiological and physicochemical quality of food. - Control food production in compliance with regulation. - Interpret results using appropriate statistical tools.
Learning outcomes	- Monitor food behavior during processing, use and consumption. - Design and formulation of foods and other bioproducts. - Understand the nature and role of the molecules used in their composition

Content	CHAPTER I : Introduction on food science - Food source - Nutrients - Energy requirements - Energy expenses - Energy intake CHAPTER II : Food microbiological quality - Microorganism evolution - Modifications causing food spoilage - Changes leading to pathogenicity risk CHAPTER III : Food colorimetric properties - Pigment definition - Pigments' functions - Colorimetric measurement techniques for food products CHAPTER IV : The aromatic properties of food - Structure and properties of aroma compounds - Main aroma compound formation pathways - Synthetic aromas - Biotechnology & Flavors
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CHAPITRE V : Rheological properties of foods

- I. Rheology of food processing fluids
- II. Rheology of food processing solids
- III. Texturing

CHAPTER VI : Food formulation and sensory analysis concepts

- I. Definition and evolution of sensory evaluation
- II. Methods
- III. Formulation sensory analysis
- IV. Formulation strategies

CHAPTER VII: Food quality legislation and standards

- I. Food safety issues
- II. Analysis of food-related risks
- III. Risk assessment
- IV. Risk management

CHAPTER VIII: Statistical process control and analysis in the food industry

- I. Setting the scene
- II. Small-series control charts
- III. Measuring control charts
- IV. Attribute control charts

Practical work

- **PW1:** Physicochemical characterization of milk (freshness test, determination of titratable acidity).
- **PW2:** Chopin Alveograph and Brabender Amylograph test.
- **PW3:** Physicochemical characterization of oils.
- **PW4:** Concept of sensory analysis of oils.

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	▪ Benbrook, C.M., (2005). Elevating antioxydant Levels in Food through Organic Farming and Food Processing p.81. The Organic Center, Foster, R.I. ▪ Science des aliments: biochimie, microbiologie, procédés, produits. Technologie des produits alimentaires. (2007). Royaume-Uni: Tec & Doc. ▪ McSweeney, P. L. H., & Sousa, M. J. (2000). Principales voies métaboliques conduisant à la production de composés aromatiques au cours de l'affinage (revue). Lait (France), 80(3).	

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29. Biological and functional foods				
Module Name	Biological and functional foods			
Module level	2 nd year			
Code	UEO311			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Ines ELLOUZE			
Lecturer	Ines ELLOUZE			
	Chalbia MANSOUR			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)		x	S3
	Food industry & processing (FIP)		x	S3
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21hrs	20-40 students
	Workshop		07 hrs	20-40 students
	PW			
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				

Module Objectives	- Provide the students with an in-depth understanding of the fundamentals of biological agriculture. - Provide the students with an in-depth understanding of the concept of functional factors. - Show the importance of functional factors and functional foods for human health
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Learning outcomes	The student will develop the ability to - Understand the basics of biological agriculture. - Understand the norms and regulations relative to biological production and biological food transformation. - Distinguish the different functional factors. - Identify functional factors beneficial effects' on human health.
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Content	● Part 1 : Biological foods ▪ Introduction ▪ CHAPTER I : Biological vegetal production - Historical aspects and importance - Basic principles of biological vegetal production 1. Principles to respect 2. Biological fruits and vegetables production 3. Biological cereals production - Principles of biological vegetal food products transformation - Norms and reglementation ▪ CHAPTER II : Biological animal production - Basic principles of biological animal production - Principles of biological animal food products transformation - Biological meat products - Biological milk and dairy products - Norms and reglementations ● Part 2 : Functional foods ▪ CHAPTER II : Ingredients from vegetal products - Relationship between food and health
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- Antioxydants
- Alimentary fibers
- **CHAPTER II : Ingredients from animal products**
 - Polyunsaturated fatty acids
- **CHAPTER III : Ingredients from biotechnology and microbiology**
 - Prebiotics
 - Probiotics
 - Synbiotics
- **CHAPTER IV : Benefits of functional foods intake**
 - Reinforcement function
 - Lowering risks function
 - Products for excess and deficiencies
 - Establishment function

Practical work

- A visit to a biological farm where can be observed all the aspects of biological agriculture and biological food products transformation

Workshop

- **PW1:** Biological foods from vegetal origin.
- **PW2:** Biological foods from animal origin.
- **PW3:** Foods and functional properties.
- **PW4:** Functional factors and their beneficial effects on human health.

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	40%
	Practical works	20%
	Written final exam	40%
	Quiz/QCM at the end of each main chapter	0%
Media employed	Digital presentations, Visit manual and Personal work series are available on ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	
Reading list	▪ RÈGLEMENT (CE) N o 834/2007 DU CONSEIL du 28 juin 2007 relatif à la production biologique et à l'étiquetage des produits biologiques et abrogeant le règlement (CEE) n o 2092/91 ▪ RÈGLEMENT (UE) 2018/848 DU PARLEMENT EUROPÉEN ET DU CONSEIL du 30 mai 2018 relatif à la production biologique et à l'étiquetage des produits biologiques, et abrogeant le règlement (CE) n o 834/2007 ▪ RÈGLEMENT (CE) N o 889/2008 DE LA COMMISSION du 5 septembre 2008 portant modalités d'application du règlement (CE) n o 834/2007 du Conseil relatif à la production biologique et à l'étiquetage des produits biologiques en ce qui concerne la production biologique, l'étiquetage et les contrôles ▪ Arrêté du minstre Tunisien de l'agriculture du 03 Décembre 2005, relatif à la production biologique ▪ ALIMENTS FONCTIONNELS. Roberfroid (coord). 2ème ed. ISBN : 978-2-7430-1860-3	

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30. Biowaste valorization				
Module Name	Biowaste valorization			
Module level	2 nd year			
Code	UEO311			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Wissem bhour			
Lecturer	Wissem bhour			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)		x	S3
	Food industry & processing (FIP)		x	S3
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21hrs	20-40 students
	Workshop		07 hrs	20-40 students
	PW			
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				

Module Objectives	- Understand the scientific, technological, and regulatory foundations of biowaste valorization. - Analyze and compare different biowaste recovery methods in terms of efficiency, sustainability, and economic viability. - Explore innovative techniques and technologies for enhancing biowaste valorization.
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Learning outcomes	The student will develop the ability to - Define biowaste valorization concepts and explain their environmental and economic importance. - Critically assess the challenges and regulatory frameworks related to biowaste recovery. - Describe and evaluate composting and anaerobic digestion processes, including key operational parameters. - Identify and analyze innovative methods and technologies in biowaste valorization. - Explain and apply basic techniques for the extraction of high value-added molecules from biowaste.
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Content	I. Introduction - Definition, scope, and significance of biowaste valorization II. The Issue of Biowaste Recovery - Environmental, economic, and regulatory challenges of biowaste management - Current practices and their limitations III. Biowaste Recovery through Composting - Principles of composting - Process parameters and optimization - Quality and applications of compost IV. Biowaste Recovery through Anaerobic Digestion - Fundamentals of anaerobic digestion - Biogas production and use - Digestate management and valorization
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- V. Innovations in Biowaste Recovery
- Emerging technologies and integrated systems
- Circular economy approaches
- VI. Extraction of High Value-Added Molecules
- Techniques for extracting bioactive compounds
- Applications in food, cosmetics, pharmaceuticals, and bio-materials
- Practical Work
- Case studies and site visits (if applicable)
- Guided work on methods for assessing compost quality, biogas yield, and molecule extraction

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>50%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>0%</td></tr> </table>	Written mid-term exam	50%	Practical works	0%	Written final exam	50%	Quiz/QCM at the end of each main chapter	0%
Written mid-term exam	50%								
Practical works	0%								
Written final exam	50%								
Quiz/QCM at the end of each main chapter	0%								
Media employed	Digital presentations, Visit manual and Personal work series are available on ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	▪ Domínguez, J. & Gómez-Brandón, M. (2021). Biowaste and Biological Waste Treatment Springer. ▪ Doble, M. & Kumar, A. (2010). Biotreatment of Industrial Effluents Butterworth-Heinemann. ▪ Awasthi, M. K., et al. (2021). Composting and Anaerobic Digestion for Organic Waste Management. Elsevier.								

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30. Cooling and freezing

Module Name	Cooling and freezing			
Module level	2 nd year			
Code	UEO312			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Hela KCHAOU			
Lecturer	Hela KCHAOU			
Language	French			
Relation to curriculum	Program	<i>compulsory</i>	Elective	Semester
	Food Industries and Processing (FIP)		x	S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21h	10-20 students	
	Workshop	7h		
	PW			
Workload	Total	28h	Self-study	25h
Credit points	2	Coefficient	1	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of total contact hours > 20% of nonattendance rate = elimination for exams			
Recommended prerequisites	UEF112 : Physics			

Module Objectives	- Memorize heat transfer principles, refrigeration cycles, and the various components of these systems. - Illustrate an understanding of the refrigeration cycle, including safety procedures and testing requirements for temperature and pressure relationships. - Illustrate the technical composition of a refrigeration equipment. - Discuss the importance and practical uses of refrigeration systems in the agri-food sector.
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Learning outcomes	- Understand heat transfer principles, refrigeration cycles, and the various components of these systems. - Demonstrate an understanding of the refrigeration cycle, including safety protocols and testing requirements for temperature and pressure relationships. - Memorize the technical composition of a refrigeration equipment. - Highlight the importance and various applications of refrigeration equipment in the agri-food sector.
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Content	Part 1: Cold Production I. Introduction to Thermodynamics and Cold: - Basic principles: Heat, temperature, heat transfer (conduction, convection, radiation). - Thermodynamics: Laws of thermodynamics, thermodynamic cycle, notion of "cold". - Definitions: Temperature, sensible heat, latent heat, enthalpy, entropy, triple point, etc. - The four stages of the refrigeration cycle: Compression, condensation, expansion, evaporation. - Examples of applications of refrigeration equipment in the food industry II. Refrigerants: Expected Qualities - Definition - Expected properties and qualities - Role of the refrigerant - The different categories of refrigerant - Fluid treatment - Thermodynamic properties - Impact on the environment - Security III. Refrigeration Machine Technology - Distribution of cold
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2. Refrigerant flow
3. The compressors
4. Evaporators and expansion valves
5. The condensers
6. Cycle with intermediate heat exchanger (single stage)
7. Cascade cycle
8. Calculation of the refrigeration load

Part 2: Use of Cold in Freezing

I. Role of negative cold in the preservation of food products

II. Behavior of frozen products

Part 3: Technical freezing section

I. Freezing Tunnel

1. Air freezing
2. Freezing with N₂ or CO₂
3. Fluidized bed
4. Freezing in contact with a refrigerant
5. Immersion freezing
6. Contact freezing

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>Written mid-term exam</td><td>40%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td colspan="2">Quiz/QCM at the end of each main chapter</td></tr> </table>	Written mid-term exam	40%	Written mid-term exam	40%	Practical works	20%	Quiz/QCM at the end of each main chapter	
Written mid-term exam	40%								
Written mid-term exam	40%								
Practical works	20%								
Quiz/QCM at the end of each main chapter									
Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/								
Reading list	▪ Langley, Billy C. Heating, Ventilating, Air Conditioning, and Refrigeration. 1990. ▪ Froid industriel. Collection : Technique et ingénierie. Francis Meunier, Paul Rivet, Marie-France Terrier.								

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30. Cooling and refrigeration

Module Name	Cooling and refrigeration			
Module level	2 nd year			
Code	UEO312			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Hela KCHAOU			
Lecturer	Hela KCHAOU			
Language	French			
Relation to curriculum	Program	<i>compulsory</i>	Elective	Semester
	Food Industries and Processing (IPA)		x	S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21h	10-20 students	
	Workshop	7h		
	PW			
Workload	Total	28h	Self-study	25
Credit points	2	Coefficient	1	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of total contact hours > 20% of nonattendance rate = elimination for exams			
Recommended prerequisites	- UEF322 : Process engineering - UEF112 : Physics			

Module Objectives	- Memorize heat transfer principles, refrigeration cycles, and the various components of these systems. - Illustrate the fundamental principles of cooling and refrigeration. - Illustrate the technical composition of a refrigeration system. - Discuss the importance and various uses of refrigeration systems in the agri-food sector.
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Learning outcomes	- Understand heat transfer principles, refrigeration cycles, and the various components of these systems. - Understand the fundamental principles of cooling and refrigeration - Memorize the different components of a refrigeration system. - Illustrate the different types of refrigerants and their properties - Highlight the importance and various applications of refrigeration equipment in the agri-food sector.
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Content	Part 1: Cold Production I. Introduction to Thermodynamics and Cold: - Basic principles: Heat, temperature, heat transfer (conduction, convection, radiation). - Thermodynamics: Laws of thermodynamics, thermodynamic cycle, notion of "cold". - Definitions: Temperature, sensible heat, latent heat, enthalpy, entropy, triple point, etc. - The four stages of the refrigeration cycle: Compression, condensation, expansion, evaporation. - Examples of applications of refrigeration equipment in the food industry II. Refrigerants: Expected Qualities - Definition - Expected properties and qualities - Role of the refrigerant - The different categories of refrigerant - Fluid treatment - Thermodynamic properties - Impact on the environment - Security
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III. Refrigeration Machine Technology

1. Distribution of cold
2. Refrigerant flow
3. The compressors
4. Evaporators and expansion valves
5. The condensers
6. Cycle with intermediate heat exchanger (single stage)
7. Cascade cycle

Part 2: Use of Cold in Refrigeration

I. Common refrigeration systems

1. Domestic and commercial refrigerators
2. Individual and central air conditioners
3. Refrigeration plants
4. Specific applications (cold rooms, etc.)

II. Industrial Applications of Cold

1. Refrigeration process in the agri-food industries
2. Applications of cold in the various agri-food sectors (meat, fish, dairy products, fruits, vegetables, confectionery and chocolates, etc.)

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>Written mid-term exam</td><td>40%</td></tr><tr><td>Practical works</td><td>20%</td></tr><tr><td colspan="2">Quiz/QCM at the end of each main chapter</td></tr></table>	Written mid-term exam	40%	Written mid-term exam	40%	Practical works	20%	Quiz/QCM at the end of each main chapter	
Written mid-term exam	40%								
Written mid-term exam	40%								
Practical works	20%								
Quiz/QCM at the end of each main chapter									
Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/								
Reading list	▪ Langley, Billy C. Heating, Ventilating, Air Conditioning, and Refrigeration. 1990. ▪ Froid industriel. Collection : Technique et ingénierie. Francis Meunier, Paul Rivet, Marie-France Terrier.								

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31. TIC Multimédia				
Module Name	TIC multimédia			
Module level	2 nd year			
Code	UET311			
Semester(s) in which the module is taught	Semester 1			
Person responsible for the module	Rihab Idoudi			
Lecturer	Rihab Idoudi			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S3
	Food industry & processing (FIP)	x		S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture			
	Workshop	28 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 the total contact hours >20 % of nonattendance = elimination for exams			
Recommended prerequisites	Module UET111 : C2I			

Module Objectives	- Explore essential Photopea tools and their functions to perform basic image editing tasks. - Practice organizing and manipulating layers to build structured visual designs. - Understand XHTML language for creating web pages - Apply fundamental CSS techniques to style and format web content effectively - Introduction to Photopea tools and features. - Experiment with basic functionality and layer management - Introduction to XHTML language for creating web pages. - Understand the basic principles of CSS for page formatting.
Learning outcomes	- Create and edit basic visual compositions using Photopea tools and layer management techniques - Design structured and well-formed web pages using XHTML - Apply CSS rules to format and style web content for improved visual presentation - Integrate images and styles elements into web pages to enhance user experience and design consistency - Use of Multimedia Software: Acquire skills in the use of image processing software (Photopea online IDE). - Integrate graphic elements with XHTML/CSS code to create a static interface.
Content	CHAPTER I: Understanding the Photopea Environment: I. Familiarization with the Photopea user interface. II. Navigation and efficient use of the different functionalities of the tool. I. Importing and exporting images. II. Changing colors and contrast levels. TD 1, 2 CHAPTER II: Working with Layers: I. Understanding the concept of layers. II. Using layers to organize and manipulate graphic elements. TD1

	CHAPTER III: Selection and Cutting Tools: I. Using selection tools to isolate specific parts of an image. II. Cutting and assembly of graphic elements. III. Exporting images in common formats TD 3, 4, 5 CHAPTER VI: Creating Simple Web Pages with XHTML and CSS IV. Introduction to Web Pages: V. Creation of structure with HTML tags. VI. Use of elements such as headings, paragraphs, lists, etc. VII. Creating Links and inserting images into a web page VIII. Integration of hypertext links. TD6 CHAPTER VI Styles and Formatting with CSS I. Use CSS style sheets to control formatting. II. Apply basic styles (colors, fonts, etc.) to different HTML elements. III. Creating simple layouts.	
Study and examination requirements and forms of examination	2DS	
	Written mid-term exam	
	Practical works	100%
	Written final exam	
	Quiz/QCM at the end of each main chapter	
Media employed	Digital presentations, TPs and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	
Reading list	▪ https://jenseign.com/apprendre-html-css/documentation-theorie/css/ ▪ https://www.eprojet.fr/cours/pdf/html-css-support.pdf ▪ https://static.oc-static.com/prod/ebooks/apprenez-a-creer-votre-site-web-avec-html5-et-css3_2016.pdf	

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32. English II				
Module Name	English II			
Module level	2 nd year			
Code	ECUET312			
Semester(s) in which the module is taught	Semester 1 (S1)			
Person responsible for the module	Narimen Kamel			
Lecturer	Imen Chebbi			
Language	English			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S1
	Food industry & processing (FIP)	x		S1
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture			
	Workshop		28hrs	20-40 students
	PW			
Workload	Total	28hrs	Self-study	50hrs
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	UCUET112 English I			

Module Objectives	- Communicate effectively in academic and professional scientific settings. - Prepare job application documents and perform well in interviews. - Develop advanced reading, writing, and speaking skills for scientific and technical contexts. - Interpret and communicate visual data accurately and clearly. - Deliver confident and well-structured oral presentations in scientific and professional environments.
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Learning outcomes	The student will develop the ability to - Complete job and academic application documents (CVs, resumes, and cover letters) tailored to scientific contexts. Demonstrate the ability to prepare for and participate in job or internship interviews using appropriate English. - Analyze and synthesize information from scientific texts, visuals, and data sources. - Interpret and explain data from charts, graphs, and tables effectively in both oral and written formats. - Write structured, clear, and concise scientific reports. - Deliver a formal oral presentation related to the student's academic field and interact constructively with audience feedback. - Show initiative and professionalism in public speaking contexts, such as conferences and meetings.
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Content	Unit I: Getting started in research - Having a career in Science - Applying for a Job/ Internship/ Exchange Programs - Applications forms - Difference between a Curriculum Vitae and a Resume - Writing a CV or a Resume - What is a Cover Letter?
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e. Preparing for an interview

Unit II: Writing skills for scientific purposes

1. Analyzing and synthesizing written and visual information
2. Reading and Interpreting charts, graphs, numbers
3. Writing reports

Unit III: Public speaking

1. Jobs interviews
 2. Interacting in conferences and professional meetings
- Presentations

Every student is supposed to deliver a ten-minute presentation related to their field of study and interact positively to the audience's feedback

Proactivity in Public speaking contexts

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written, oral mid-term exam	100%
	Practical works	0%
	Written final exam	0%
Media employed	Quiz/QCM at the end of each main chapter	
	0%	
Reading list	Digital presentations, Visit manual and Personal work series are available on ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	
	▪ Williams, Ivor. English for Science and Engineering. Professional English Series, 2007. ▪ Donovan Peter. Basic English for Science. English Language Oxford University Press, 2008. ▪ Ibbotson, Mark. Professional English in Use: Engineering. Cambridge University Press, 2009.	

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33. Bioprocess engineering				
Module Name	Bioprocess Engineering			
Module level	2 nd year			
Code	UEF410			
Semester(s) in which the module is taught	Semester 4 (S4)			
Person responsible for the module	Fatma Bouaziz			
Lecturer	Fatma Bouaziz			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S4
	Food industry & processing (FIP)	x		S4
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	7 hrs	20-40 students	
	PW	0 hrs		
Workload	Total	28 hrs	Self-study	47 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 UEF222: Microbiology (or equivalent) - Module UEF321: Food microbiology (or equivalent)			

Module Objectives	- Introduce the different sectors of biotechnology. - Describe the different industrial uses of microorganisms. - Study fermentation - Describe fermentation parameters and fermentation processes. - Study microbial kinetics. - Help students put the fermentation technology “preparation of lactic ferments”.
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Learning outcomes	The student will be able to: - Know the generalities about microorganisms. - Describe the stages of fermentation and fermentation parameters - Differentiate the three fermentation processes - Calculate the major fermentation parameters which are growth yield and productivity. - Implement industrial fermentations - Describe the steps necessary for the preparation of lactic ferments
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Content	Introduction - Definition and history - The different sectors of biotechnology Chapter I: Industrial use of microorganisms Section I: General information on microorganisms Section II: Fermentation Section III: Other microbial uses Section IV: Implementation of industrial fermentations Chapter II: Microbial Kinetics Introduction Section I: Chemical assessment Section II: The biological phenomenon Section III: Growth curves Section IV: Factors Affecting Growth Rates
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Section V: Growth yield and productivity

Chapter III: Fermentation technology “preparation of lactic ferments”

Section I: Preparation of the inoculum

Section II: Preparation of the culture medium

Section III: Spread of bacteria

III.1: Fermentation parameter

III.2: Fermentation processes.

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	Gerard J. Tortora, Berdell R. Funke, Christine L. Case, Adapt. de Louise Martin. Introduction à la microbiologie. Edition: Editions de renouveau pédagogique : Quebec 2003 ISBN: 27613134539782761313452	
	C. M. Bourgeois, J. P. Larpent. Microbiologie alimentaire. Edition: Tec & doc-Lavoisier : Paris, Londres, New York 1996. ISBN: 2743008822, Collection: Collection Sciences & techniques agroalimentaires.	

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34. Preservation Techniques				
Module Name	Preservation Techniques			
Module level	2 nd year			
Code	UEF412			
Semester(s) in which the module is taught	Semester 4 (S4)			
Person responsible for the module	Fatma Bouaziz			
Lecturer	Adnen SAIDANI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S4
	Food industry & processing (FIP)	x		S4
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop			
	PW	10.5 hrs	10-20 students	
Workload	Total	31.5 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	- Module UEF222: Microbiology (or equivalent) - Module UEF321 : Food Microbiology (or equivalent)			

Module Objectives	- Identifying and understanding the principles, advantages, and disadvantages of the main methods for preserving agricultural products. - Understanding the mechanisms of food transformation during preservation. - Knowing the different preservation methods and being able to choose the one that suits the specific properties of the food.
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Learning outcomes	- Knowing the fundamental principles of the main methods of preserving agri-food products. - Distinguishing between different thermal processing methods used in food preservation and processing.. - Conducting practical experiments to evaluate the effects of heat treatments on food quality and safety, and interpret the resulting data. - Performing the calculations related to the sterilization process and its importance in food safety. - Knowing the microbial alterations in processed foods and methods of control.
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Content	Introduction General overview of food spoilage and the role of processing in preserving quality Chapter I: Heat treatment technology Section I: Blanching Section II: Pasteurization Section III: Sterilization Section IV: Canning Chapter II: Destruction of microorganisms by heat treatments Section I: Thermo bacteriology Section II: Calculation of sterilization scales Section III: Factors involved in sterilization Chapter III: Industrial processing of fruits and vegetables
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Section I: Cleaning and preliminary operations
 Section II: Blanching
 Section III: Casing
 Section IV: Jutting
 Section V: Crimping
 Section VI: Sterilization cycle
 Section VII: Microbial alterations
 Section VIII: Control of the stability of canned foods

Practical work

- **PW 1:** Impact of pasteurization temperature on the fresh juice quality
- **PW 2:** Visit a company (Daily'n):
 - Understanding the egg pasteurization technique.
 - Understanding the baking of cakes and the associated principles.
 - Learning about microbiological analyses.
 - Knowing the different food packaging techniques and their impacts.

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	5%
	Workshop (Applications and problem-based learning)	5%
	Practical works	20%
	Written final exam	70%

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	▪ James, Ife Fitz, and Bas Kuipers. AD03F La conservation des fruits et des légumes. Agromisa Foundation, 2003. ▪ Boeckel, Thomas P. van, Joseph D. Hounhouigan, and Robert Nout. Les aliments: transformation, conservation et qualité. Technical Centre for Agricultural and Rural Cooperation, 2003.

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35. Plant Production Systems				
Module Name	Plant production systems			
Module level	2 nd year			
Code	UEF421			
Semester(s) in which the module is taught	Semester 4 (S4)			
Person responsible for the module	Hela KCHAOU			
Lecturer	Adnen SAIDANI			
	Hela KCHAOU			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	Food Quality Control (FQC)	x		S4
	Food industry & processing (FIP)	x		S4
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop			
	PW	17,5 hrs	10-20 students	
Workload	Total	28.5 hrs	Self-study	37 hrs
Credit points	3		Coefficient	1,5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of non attendance = elimination for exams			
Recommended prerequisites	- Module ECUEF141 : Plant biology (or equivalent) - Module ECUEF231 : Plant physiology (or equivalent)			

Module Objectives	- Introduce the essential notions of agronomy and identify the fundamental knowledge necessary to control plant production. - Study the interactions between the growth of plant cover and environmental factors (water, radiation, pathogens, etc.). - Integrate this knowledge for the acquisition of analysis tools: functional models and applications. - Analyze the components of the development of cultivated plants at different levels. - Identify and understand the interactions between the development of cultivated plants, their environment and cultural practices.
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Learning outcomes	- Learn the basic notions of agronomy and know the biological and physical concepts necessary for controlling plant production. - Understand the interactions between the growth of plant cover and environmental factors. - Distinguish operating, production and cultivation systems and understand the role of the agronomist. - Have an idea about the model used as an analysis tool. - Identify the components of cultivated plant development at different levels of integration: cell, organ, whole plant and population. - Understand the interactions between the development of cultivated plants, their environment (soil, climate, etc.) and cultural practices (sowing date, fertilization, irrigation, weeding, pruning, etc.).
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Content	Part A: Principles of Agronomy and Plant-Cover Operation - Agriculture and agronomy: definitions, developments and perspectives. - Operating, production and cultivation systems. - Reasoning of the technical itinerary according to the growth and development of the plants. - Primary production, growth analysis, carbon cycle and modeling. - Effect of environmental constraints (abiotic and biotic) on the growth of plant populations. Part B: Cultivated plants
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1. Woody fruit plants: case of vines
2. Forage crops : Types, management and utilization
3. Cereals : Major cereal crops, production systems
4. Oilseeds: case of Sunflower
5. Vegetable plants : Production systems and management

Practical work :

- Recognition of seeds of the main forage species and cereals.
- Agricultural practices and machinery.
- Evaluation of the crops state on the plot (growth rate, efficiency of radiation interception, efficiency of water use, etc.).
- Methods for combating plant diseases, weeds and drought, applied on the plot.
- Methods and techniques to improve crop yield.

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

- Biarnès, A. (1998). La Conduite du champ cultivé: points de vue d'agronomes. Ed. ORSTOM, ISBN : 2-7099-1387-9.
- Makowski, D., Nesme, T., Papy, F., & Doré, T. (2014). Global agronomy, a new field of research. A review. *Agronomy for sustainable development*, 34, 293-307. <https://doi.org/10.1007/s13593-013-0179-0>.
- Renaud-Gentié, C. (2015). Eco-efficience des itinéraires techniques viticoles: intérêt et adaptations de l'analyse du cycle de vie pour la prise en compte des spécificités de la viticulture de qualité. Thèse de doctorat. Université d'Angers
- Doré, T. (2022). Evolution des domaines, objets, concepts de l'agronomie. La fabrique de l'agronomie De 1945 à nos jours, pp.23-67. Ed. Quae, ISBN : 978-2-7592-3541-4.

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M36. Unit Operations

Module Name	Unit operations			
Module level	2 nd year			
Code	UEF422			
Semester(s) in which the module is taught	Semester 4 (S4)			
Person responsible for the module	Meriem SMADHI			
Lecturer	Meriem SMADHI			
	Ghofrane Charrada			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	Food Quality Control (FQC)	x		S4
	Food industry & processing (FIP)	x		S4
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	10.5 hrs	20-40 students	
	PW	07 hrs	10-20 students	
Workload	Total	38.5 hrs	Self-study	37 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 UEF322 : Process Engineering			

Module Objectives

- Introduce and review unit operations.
- Recognize the various unit operations (extraction, distillation, evaporation, Drying)
- Describe the material and energy account balances.
- Introduce the concept of drying and humid air.
- Help students put fractional distillation into practice, extract for a given natural substance and food product drying.

Learning outcomes

- Recognize the various unit operations.
- Describe the principle of extraction.
- Calculate the different material and energy balances.
- Recognize the liquid-vapor equilibrium diagram for distillation.
- Estimate and calculate the theoretical plateaus for column distillation.
- Use the psychrometric diagram to know the physical characteristics of humid air.
- Implement an experimental protocol for extraction, fractional distillation and drying food products.
- Write a report clearly and concisely.

Content

CHAPTER I: Extraction

- Principle
- Extractor calculations
- Concept of transfer unit
- Technology and applications

CHAPTER II: Distillation

- Basic principles and calculation data
- The vapor liquid diagram
- Principle of column distillation (Notion of theoretical plateaus)
- Material and energy balances

CHAPTER III: Evaporation

- Definition

- Objectives
- Estimation of thermal properties of aqueous solutions
- Material and energy balances
- Consumption and energy saving in evaporation

CHAPTER IV: Drying and Humid Air

- Introduction
- The humidity balance between air and product
- Humid air
- Use of the humid air diagram in drying Physical principles of drying
- Drying by training
- Boiling drying technology and calculation of dryers

CHAPTER V: Stirring and texturing operations

CHAPTER VI: Mechanical operations on bulk powders

CHAPTER VII: Mechanical manufacturing operations (individualized objects)

Practical works

- **PW1:** Study of fractional distillation
- **PW2:** Extraction of caffeine from tea leaves
- **PW3:** Drying of a food product by freeze-drying: Comparison with conventional drying
- **PW4 :** Extraction of nicotine from tobacco leaves

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>5%</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>5%</td></tr> </table>	Written mid-term exam	5%	Practical works	20%	Written final exam	70%	Quiz/QCM at the end of each main chapter	5%
Written mid-term exam	5%								
Practical works	20%								
Written final exam	70%								
Quiz/QCM at the end of each main chapter	5%								
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	▪ Johanne B., Olivier C (2019). Génie chimique et des procédés. Dunod, ISBN 10-2100788930, 240 p.								

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M37. Quality control management				
Module Name	Quality control management			
Module level	2 nd year			
Code	ECUEF431			
Semester(s) in which the module is taught	Semester 4 (S4)			
Person responsible for the module	Maissa Khemakhem			
Lecturer	Maissa Khemakhem			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S4
	Food industry & processing (FIP)	x		S4
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	14 hrs	20-40 students	
	PW	-	-	
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 UET211 : Management (or equivalent)			

Module Objectives	- Understand the key concepts of quality through a historical approach, its definitions and the study of its principles. - Know the different principles of food hygiene. - Help students set up a quality management system. - Help students implement a HACCP system..
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Learning outcomes	- Differentiate between quality assurance, quality control and total quality - Know how to set up a quality approach - Engage in a process of continuous improvement - Master quality tools - Know and understand general principles of food hygiene (fields of application, control of operations, maintenance and sanitation...). - Master the application guidelines of the HACCP system and know how to perform a logical sequence and apply it. - Be familiar with ISO system, standardization, management principles.
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Content	CHAPTER I: Current Quality Practices 1- Introduction 2- Concept of total quality 3- Quality Assurance 4- Place of Quality Management CHAPTER II: General principles of food hygiene 1- Hygiene Scope 2- Operations Control 3- Cleaning and Sanitation 4- Waste Disposal 5- Consumer Vigilance CHAPTER III: Hazard Analysis and Critical Control Points (HACCP) 1- Introduction 2- Scope 3- Objectives and Benefits 4- Terminologies
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- 5- Principles
 - 6- HACCP System Application Guidelines
 - 7- Logical sequence of implementation

CHAPTER IV: ISO 22000

- 1- General description of the ISO 22000
 - 2- Benefits of International Standardization
 - 3- PRP, PRPo and CCPs
 - 4- Managing food safety risks
 - 5- Correlation with BRC and IFS
-

Study and examination requirements and forms of examination

Mixed evaluation
The final score is weighted as follows:

Written mid-term exam	30%
Written final exam	70%
Quiz/QCM at the end of each main chapter	0%

Media employed

Course materials are available on the ISBB website: <https://isbb.rnu.tn/>
Video projection

Reading list

- Claude-Yves Bernard : Le management par la qualité totale –« L'excellence en efficacité et en efficience opérationnelles » ; (Afnor, 2000)
 - Codex alimentaire
 - ISO 14001 :2015 : Systèmes de management environnemental — Exigences et lignes directrices pour son utilisation
 - ISO 9000 :2015 : Systèmes de management de la qualité — Principes essentiels et vocabulaire.
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M38. Metrology				
Module Name	Metrology			
Module level	2 nd year			
Code	UEF432			
Semester(s) in which the module is taught	Semester 4 (S4)			
Person responsible for the module	Haifa SEBII			
Lecturer	Haifa SEBII			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S4
	Food industry & processing (FIP)	x		S4
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	07 hrs	20-40 students	
	PW	14 hrs	10-20 students	
Workload	Total	42 hrs	Self-study	33 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 UEF111 : Applied Mathematics (or equivalent)			

Module Objectives	- Acquisition of the principles of metrology in business: generic requirements and application guides for the management of the measurement process. - Confirmation of measurement equipment used to demonstrate the conformity of processes and products. - Implementation of control procedures to ensure the reliability and accuracy of measurements.
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Learning outcomes	- Understanding units of measurement and measurement errors. - Preparing measurement reports. - Estimating measurement uncertainties using physical means and statistical calculations. - Understanding the role of metrology in quality systems. - Differentiating between calibration and verification of measuring instruments. - Understanding accreditation requirements and procedures in metrology.
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Content	CHAPTER I. GENERALITIES - Definition, terminology - Concepts of calibration, verification, and traceability - Analysis of the measurement process - Estimation of uncertainty - Using measurement uncertainties to choose an instrument and a measurement method CHAPTER II. CALCULATION OF STANDARD UNCERTAINTIES - Dispersion and variance - Type A and Type B evaluation methods - Covariance, independence of measurements CHAPTER III. DETERMINATION OF COMBINED UNCERTAINTY - Law of propagation of uncertainties - Practical application of the law of propagation of uncertainties CHAPTER IV. DETERMINATION OF EXPANDED UNCERTAINTY - Confidence interval and confidence level, degrees of freedom - Expansion factor - Final expression of the result
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CHAPTER V. MANAGEMENT AND EXPLOITATION OF RESULTS

1. Quality control of analysis results
2. Evaluation of uncertainties
3. Proficiency testing and internal repeatability and reproducibility tests

Practical Work

- **PW1:** Determination of the accuracy error of a balance
- **PW2:** Development of a life sheet for equipment
- **PW3:** Simulation of the accreditation procedure

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	▪ Authouart, Frédéric. La métrologie, mais c'est très simple!. Crisalis, 2014. ▪ CICERO, Jérémy. "Métrologie: un peu de vocabulaire." (2011). ▪ Boilley, David. "Eléments de métrologie: incertitudes et analyse des résultats de mesure." Université de Caen Basse-Normandie et GANIL (2011).	

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M39. Sampling Techniques					
Module Name	Sampling techniques				
Module level	2 nd year				
Code	UEO411				
Semester(s) in which the module is taught	Semester 4 (S4)				
Person responsible for the module	Haifa SEBII				
Lecturer	Haifa SEBII				
	Haifa SEBII				
Language	French				
Relation to curriculum	Program		Compulsory	Elective	Semester
	Food Quality Control (FQC)			X	S4
	Food industry & processing (FIP)			X	S4
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		21 hrs	20-40 students	
	Workshop		07 hrs	20-40 students	
	PW				
Workload	Total	28	Self-study	25 hrs	
Credit points	2		Coefficient	1	
Requirements according to the examination regulations	▪ Minimum attendance rate: 80% of planned contact hours An absenteeism rate > 20% = elimination of module exams				
Recommended prerequisites	▪ UEF111: Applied mathematics (or equivalent)				

Module Objectives	- Know the sampling plans most often used in practice by government statistical agencies and polling institutes - Estimate the gains or losses in precision of the various estimators, compared to a naive draw such as simple random draw
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Learning outcomes	- Know and understand the structure of a sample survey - Describe the different sampling distributions - Select and apply the appropriate sampling strategy - Implement sampling protocols
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Content	I. Structure of a sample survey Design and planning: target population; variable(s) of interest; quiz; sampling frame. Execution of the preconceived plan: (1) sample drawing, (2) data collection, (3) data verification and imputation, (4) estimation and analysis, (5) publication of results. II. Sampling 1. Introduction 2. Terminology. 3. Sampling. 3.1. Definition. 3.2. Sampling methods. 3.2.1. Probabilistic (Random) methods. - Simple random sampling. - Stratified random sampling. - Random cluster sampling. - Systematic random sampling. 3.2.2. Non-probabilistic methods (Reasoned or Empirical) - Quota sampling. - Convenience sampling. - Sampling according to judgment.
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- Snowball sampling.

4. Sampling distribution.

4.1. Sampling distribution of the mean.

4.2. Sampling distribution of variance.

4.3. Frequency sampling distribution.

4.4. Sampling distribution of the difference of means.

5. Summary

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>Written mid-term exam</td><td>40%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td colspan="2">Quiz/QCM at the end of each main chapter</td></tr> </table>	Written mid-term exam	40%	Written mid-term exam	40%	Practical works	20%	Quiz/QCM at the end of each main chapter	
Written mid-term exam	40%								
Written mid-term exam	40%								
Practical works	20%								
Quiz/QCM at the end of each main chapter									
Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/								
Reading list	▪ https://www.techniques-ingenieur.fr/base-documentaire/archives-th12/archives-techniques-d-analyse-tiata/archive-2/echantillonnage-p220/								

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39. Design of experiments

Module Name	Design of experiments			
Module level	2nd year			
Code	UEO411			
Semester(s) in which the module is taught	Semester 4 (S4)			
Person responsible for the module	Haifa SEBII			
Lecturer	Haifa SEBII			
Language	French			
Relation to curriculum	Program	<i>compulsory</i>	Elective	Semester
	Food Industries and Processing (IPA)		x	S4
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 H	30-50 students	
	Workshop	7H		
	PW		10-20 students	
Workload	Total	25	Self-study	25H
Credit points	2	Coefficient	1	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of planned contact hours - An absenteeism rate > 20% = elimination of module exams			
Recommended prerequisites	UET513: Biostatistics I and bioinformatics I			

Module Objectives	- Understand the fundamental principles of scientific research methodology. - Design valid and reliable experiments to test hypotheses. - Apply appropriate sampling techniques and experimental designs in various fields. - Learn how to control variables and reduce experimental errors. - Develop skills in planning, conducting, analyzing, and reporting experimental research. - Critically evaluate published experimental studies for methodological soundness.
Learning outcomes	- Explain key concepts in research methodology including variables, controls, validity, and reliability. - Design experiments using different experimental designs (completely randomized, factorial, block designs, etc.). - Select suitable sampling methods and calculate sample sizes. - Implement randomization and blinding to minimize bias. - Analyze experimental data using basic statistical methods. - Write clear and comprehensive experimental reports with appropriate interpretation of results. - Critically appraise experimental research articles for design quality and validity.

Content	Introduction to Research Methodology - Scientific method - Types of research (qualitative, quantitative, mixed) - Variables and Hypotheses - Independent, dependent, confounding variables - Formulating testable hypotheses Chap1. Experimental Design Basics - Control groups - Randomization and replication - Common Experimental Designs - Completely randomized design (CRD) - Randomized block design (RBD) - Factorial designs Chap3. Sampling Techniques - Probability and non-probability sampling - Sample size determination
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- Controlling Bias and Error
 - Sources of experimental error
- Data Collection Methods and Tools
- Surveys, instruments, observational methods

Chap3. Introduction to Data Analysis

- Descriptive statistics
- Basic inferential statistics

Chap 4. Statistical Tools for Experimental Data

- t-tests, ANOVA
- Interpretation of p-values and confidence intervals
- Ethical Considerations in Experimental Research
- Informed consent
- Research ethics guidelines

Chap 5. Writing and Presenting Experimental Reports

- Structure of scientific reports
- Data presentation (tables, graphs)

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>40%</td></tr> <tr> <td>Written mid-term exam</td><td>40%</td></tr> <tr> <td>Practical works</td><td>20%</td></tr> <tr> <td colspan="2">Quiz/QCM at the end of each main chapter</td></tr> </table>	Written mid-term exam	40%	Written mid-term exam	40%	Practical works	20%	Quiz/QCM at the end of each main chapter		
Written mid-term exam	40%								
Written mid-term exam	40%								
Practical works	20%								
Quiz/QCM at the end of each main chapter									
Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/								
Reading list	▪ Creswell, J. W. (2014). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Sage Publications. ▪ Kirk, R. E. (2013). Experimental Design: Procedures for the Behavioral Sciences (4th Edition). Sage Publications.								

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40. Food formulation and innovation				
Module Name	Food Formulation and innovation			
Module level	2 nd year			
Code	UEO412			
Semester(s) in which the module is taught	Semester 4 (S4)			
Person responsible for the module	Ola ABDELHEDI			
Lecturer	Takoua Ben Hlel			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)		x	S4
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-30 students	
	Workshop	07 hrs	20-30 students	
	PW	10.5 hrs	10-15 students	
Workload	Total	38.5 hrs	Self-study	15 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 UEF211 (ECUEF211) : Structural biochemistry (or equivalent)			

Module Objectives	- Differentiate between the types of interfaces (air, oil); - Understand the encapsulation processes and their role in a food formulation; - Development and manufacturing of a commercial food product; - Capacity to optimize and formulate products with desired specifications in order to respond to the requirements of the research and development axis in companies.
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Learning outcomes	The student will be able to: - Distinguish the differences between food matrices types - Understand the microencapsulation to formulate a food product - Innovate in the food sciences by the development of novel formulations, responding to specifications and by implementing a research and development approach - Establish and respond to the requirements of specifications and market/industrial requirements.
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Content	Chapter I: Introduction to the physico-chemistry of formulation - Amphiphilic molecules - Polymers - Polymer – surfactant synergy Chapter II: Emulsions, dispersions and foams - Processes for producing emulsions - Mechanisms of degradation of an emulsion - Colloidal dispersions - Foams and anti-foams Chapter III: The different micro-encapsulation processes - Micronization/atomization - Ionotropic gelation - Liposomes - Microemulsion Chapter IV: Formulation of the taste of food products - Define taste - Describe the taste using basic ingredients
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3. Test and refine sensory interactions
4. Taste formulation methodology

Chapter V: Formulation of ice creams, ice creams and sorbets

1. Presentation
2. Main rules of formulation
3. Ingredients used in manufacturing
4. Manufacturing technology: operations and materials
5. Quality control

Practical work

- **PW1:** Development of specifications for the development of a food product (Defines quantifiable technical characteristics including formats, physico- chemical, organoleptic, microbiological, nutritional and costs)
- **PW2:** Industrial visit to “Daily’n” company (specialized in the production of cakes and pastries)

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>Case Study</td><td>10%</td></tr> </table>	Written mid-term exam	35%	Written mid-term exam	35%	Practical works	20%	Case Study	10%
Written mid-term exam	35%								
Written mid-term exam	35%								
Practical works	20%								
Case Study	10%								
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	● TECHNIQUES D'ANALYSE ET DE CONTROLE DANS LES INDUSTRIES AGRO-ALIMENTAIRES, Volume 4 : Analyse des constituants alimentaires. Lavoisier 1981, ISBN 2-85206 085-X ● BIOCHIMIE ALIMENTAIRE - 6ème édition de l'abrégé. Dunod 2008, ISBN: 987-2-10-051930-9 ● SCIENCE ET TECHNOLOGIE DES ALIMENTS : Principes de chimie des constituants et de technologie des procédés. Presses polytechniques et universitaires romandes : Lausanne 2010, ISBN: 9782880747541 ● Food Formulation. Novel Ingredients and Processing Techniques. Shivani Pathania, Brijesh K. Tiwari, Wiley-Blackwell 2021, 1st edition.								

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M40. Environmental Management				
Module Name	Environmental Management			
Module level	2 nd year			
Code	UEO412			
Semester(s) in which the module is taught	Semester 4 (S4)			
Person responsible for the module	Bouthaina GHARIANI			
Lecturer	Bouthaina GHARIANI			
Language	French			
Relation to curriculum	Program	<i>compulsory</i>	Elective	Semester
	Food Industries and Processing (IPA)			
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-30 students	
	Workshop	07 hrs	20-30 students	
	PW	10.5 hrs	10-15 students	
Workload	Total	38.5 hrs	Self-study	15 hrs
Credit points	2	Coefficient	1	
Requirements according to the examination regulations	- Minimum attendance rate: 80% of total contact hours > 20% of nonattendance rate = elimination for exams			
Recommended prerequisites				

Module Objectives	- Understand current and future environmental challenges. - Know the tools, standards, and methods used in environmental management. - Identify environmental impacts of human and industrial activities. - Propose preventive and corrective environmental actions. - Understand environmental regulations at national and international levels.
Learning outcomes	- Identify and assess environmental impacts. - Master key concepts such as sustainable development, life cycle analysis, and eco-design. - Apply Environmental Management Systems (EMS). - Understand circular economy and ecological transition principles.

Content	Chapter 1: Introduction to Environmental Management I. Key definitions and concepts II. Historical background of environmental concerns III. Global challenges: climate change, biodiversity loss, pollution Chapter 2: Environmental Impact Assessment I. Identification of pollution sources (air, water, soil) II. Impact analysis methods III. Environmental Impact Studies (EIA) Chapter 3: Environmental Management Systems (EMS) I. ISO 14001 and EMAS standards II. Developing an environmental policy III. Environmental audits VI. Environmental performance indicators Chapter 4: Sustainable Development and Circular Economy I. UN Sustainable Development Goals (SDGs) II. Ecological footprint and sustainability III. Eco-design, recycling, and waste valorization Chapter 5: Environmental Regulations and Responsibility I. Legal frameworks (national and international) II. Corporate environmental and social responsibility (CSR)
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III. Environmental risks and the precautionary principle
 Chapter 6: Operational Tools and Approaches
 I. Life Cycle Assessment (LCA)
 II. Carbon and water footprint
 III. Environmental Management Plans (EMP)
 VI. Case studies in industrial sectors

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>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>Case Study</td><td>10%</td></tr> </table>	Written mid-term exam	35%	Written mid-term exam	35%	Practical works	20%	Case Study	10%
Written mid-term exam	35%								
Written mid-term exam	35%								
Practical works	20%								
Case Study	10%								
Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/								
Reading list	▪ Daniel C. Esty & Andrew S. Winston – <i>Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage</i> ▪ ISO 14001:2015 – Environmental Management Systems – Requirements with Guidance for Use. The official standard for implementing an environmental management system (EMS). www.iso.org ▪ IPCC Reports (Summary for Policymakers) – Latest Assessment Reports (AR6, 2023). Scientific foundation for climate-related aspects of environmental management. www.ipcc.ch								

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M40. Food Traceability				
Module Name	Food Traceability			
Module level	2 nd year			
Code	UEO412			
Semester(s) in which the module is taught	Semester 4 (S4)			
Person responsible for the module	Hela Kchaou			
Lecturer	Hela kchaou			
	Hela Kchaou			
Language	French			
Relation to curriculum	Program		Compulsory	Elective
	Food Industries and Processing (FIP)			x
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21 hrs	15-20 students
	Workshop		07 hrs	15-20 students
	PW		10.5 hrs	7-10 students
Workload	Total	38.5h	Self-learning	15 hrs
Credit points	2		Coefficient	1
Requirements according to the examination regulations	▪ Minimum attendance rate: 80% of planned contact hours An absenteeism rate > 20% = elimination of module exams			
Recommended prerequisites	▪ UET212 Management (or equivalent)			

Module Objectives	- Know the benefits of a traceability system. - Know the different types of traceability. - Know the different traceability tools. - Know the elements of a traceability system.
Learning outcomes	- Know food traceability standards. - Be able to set up a traceability system.

Content	Chapter 1: Objectives and elements of a traceability system 1.1. How to define traceability? 1.2. The purposes and objectives of traceability 1.3. Traceability approaches 1.4. What are the obstacles and limits of traceability? 1.5. Traceability requirements 1.6. Elements of a product traceability system Appendices Chapter 2: Setting up a traceability system 2.1. Implement a traceability management system 2.2. Develop an action plan 2.3. How to develop traceability procedures? Chapter 3: Traceability tools 3.1. Information supports 3.2. Product marking Appendix – International codes AI/ General introduction and regulations II / Traceability and food safety III/ Traceability and quality system IV/ Traceability and HACCP system V/ The different types of traceability VI/ Codification and traceability
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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%
	Quiz/QCM at the end of each main chapter
Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/
Reading list	<i>Regulation (EC)178/2002 on the traceability of foodstuffs.</i> ISO 22005, Traceability system in the food chain – General principles relating to design and implementation.

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41 Corporate Culture				
Module Name	Corporate Culture			
Module level	2 nd year			
Code	ECUET411			
Semester(s) in which the module is taught	Semester 4 (S4)			
Person responsible for the module	Lobna Essid			
Lecturer	Lobna Khaloui			
Language	English			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S4
	Food industry & processing (FIP)	x		S4
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture			
	Workshop	21hrs	20-40 students	
	PW			
Workload	Total	21hrs	Self-study	30hrs
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 special prerequisites			

Module Objectives	- Understand all steps to start a project - Understand the financial and legal issues related to starting a project
Learning outcomes	The student will develop the ability to - Be familiar with the terms and formalities necessary for setting up a business, - Use all the knowledge on process, legal and economic issues to start up a project - Understand the business creation process and identify the different stages and their constraints. - Analyze a concrete and complex business creation situation. - Analyze the risks and choose the appropriate action plans. - Carry out a financial plan over 3 years (balance sheet, profit and loss, cash flow plan). - Present and defend the project in front of an audience.

Content	Chapter I: General introduction - Definition and objectives of a project - Type of projects - Typology of companies - Actors involved in a project - The economic and financial environment of the company - The Business model canvas (BMC): Application and workshop Chapter II: Stages of business creation - The profile of the creator and entrepreneurial culture - Identification of a project: idea and opportunities - Market research - Feasibility study - Profitability study: Economic and financial evaluation - Financing Plan
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7. Study of the preliminary implementation project

Chapter III: Preparation of the project

1. The market and commercial means
2. Means of production
3. Human resources
4. Space requirements
5. Development of a business plan

Chapter IV: Financial evaluation methods of a project

1. The cost of the investment
2. The instruments and methods for calculating the profitability of the project
3. Capitalization and discounting
4. Net Present Value Method
5. Internal rate of return method
6. Choice and decision criteria
7. Case studies

Chapter V: The method of financing companies

1. Self-financing
2. Equity
3. Debt
4. The industrial promotion fund, SICAR, spin-off

Project financing scheme

Chapter VI: The legal file of the company

1. Legal formalities and constitution of a company:
2. Statutes, trade register, agreement (API, CEPEX,...) Tax registration number, publication in the official journal,...
3. Capital formation and payment of shares

Chapter VII: Environment and support for business creation in Tunisia.

1. Business environment and export support
2. Administrative and technical support
3. Supervision and training of young promoters, business incubators

Role of Tunisian National Institutions in promoting business Startup: API, APIA, BTS, BFPME,

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows:
	Written mid-term exam 50%
	Practical works 0%
	Written final exam 50%
	Quiz/QCM at the end of each main chapter 0%
Media employed	Digital presentations, Visit manual and Personal work series are available on ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	▪ Casteran S., Créer son entreprise, PRAT, 2008. ▪ Frogier V., La création d'entreprise de A à Z, Dunod, 2007. ▪ Le Guern P., Isabello, J., Créer son entreprise, Jacob-Duvernet, 2006. ▪ Montbello M., Création d'entreprise : Connaissances et Analyses Stratégiques, Economica, 2004. ▪ Moschetto B. L., Le Business Plan, Economica, 3^{ème} édition, 2005. ▪ Portella A., Trouver Une Idée de Création d'Entreprise, Studyrama, 2009. ▪ Stutely R., Concevoir un Business plan Efficace, Village Mondial, 2^{ème} édition, 2005. ▪ Triquère C., Le Grand livre de la Création d'Entreprises, Studyrama, 2009. ▪ Verstaete T., Saporta., B., Création d'Entreprise et Entrepreneuriat, Editions de l'ADREG, 2006.

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42 Bioethics and biosecurity				
Module Name	Bioethics and biosecurity			
Module level	2 nd year			
Code	ECUET412			
Semester(s) in which the module is taught	Semester 4 (S4)			
Person responsible for the module	Chiraz Zayed			
Lecturer	Chiraz Zayed			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S4
	Food industry & processing (FIP)	x		S4
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture			
	Workshop	28hrs	20-40 students	
	PW			
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	No special prerequisites			

Module Objectives	- Increase the student's employability - Develops the full spectrum of advanced ethical and professional skills Clearly distinguish between personal, theoretical and professional ethics
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Learning outcomes	The student will develop the ability to - Conduct his/her work activity ethically - Identify and discuss the central ethical problem - Identify affected parties and their interests - Search for possible solutions for the dilemma - Evaluate each solution using the interests of those involved, accorded suitable priority. - Understand leaders' ethical responsibilities
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Content	Introduction - Ethics Guide - Thinking about Ethical decisions - Rules vs Principals - Fundamental Principals - The framework - Innovation Ethics - Innovation Ethics for value based Innovation - Technological evolution, innovations and ethical concerns and dilemmas - A framework for understanding (un) ethical decision-making process - Innovation process models and decision making - Moral imagination, systems thinking and multiple perspective approach
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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>50%</td></tr> <tr> <td>Written mid-term exam</td><td>50%</td></tr> <tr> <td>Practical works</td><td>0%</td></tr> </table>	Written mid-term exam	50%	Written mid-term exam	50%	Practical works	0%
Written mid-term exam	50%						
Written mid-term exam	50%						
Practical works	0%						

Written final exam	0%
Quiz/QCM at the end of each main chapter	0%

Media employed	Digital presentations, Visit manual and Personal work series are available on ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	▪ Books and handouts, websites, ▪ Innovation Ethics. African and Global Perspectives. (2014).ISBN 978-2-88931-003-6. ▪ Innovation process and ethics in technology: an approach to ethical (responsible) innovation governance. Nathan.Journal on Chain and Network Science 2015; 15(2): 119-134

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43. Science and Technologies of Milk and dairy products				
Module Name	Science and technologies of milk and dairy products			
Module level	3rd year			
Code	EEF511			
Semester(s) in which the module is taught	Semester 5 (S5)			
Person responsible for the module	Mourad JRIDI			
Lecturer	Haifa SEBII			
Language	French			
Relation to curriculum	Program	<i>compulsory</i>	Elective	<i>Semester</i>
	Food Industries and Processing (IPA)	x		S5
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21 H	10-20 students
	Workshop			
	PW		17.5 H	10-20 students
Workload	Total	38.5	Self-study	37 H
Credit points	3		Coefficient	1.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of total contact hours > 20% of nonattendance rate = elimination for exams			
Recommended prerequisites	ECUEF311 module: food biochemistry 1			

Module Objectives	- Know the chemical composition and physical and microbiological properties of milk - Know the different milk preservation techniques - Know the different dairy products and their manufacturing processes - Establish the relationship between the manufacturing conditions of dairy products and manufacturing defects.
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Learning outcomes	- Know the chemical composition and physical and microbiological properties of milk - Know the different milk preservation techniques - Know the different dairy products and their manufacturing processes - Establish the relationship between the manufacturing conditions of dairy products and manufacturing defects.
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Content	Chapter I: Milk Introduction: Definition I: Composition of milk II: Characteristics and constituents of milk III: Mechanical processes: homogenization and separation Chapter II: Conservation of milk I: Refrigeration of milk II: Preservation by heat Chapter III: Cheese technology Introduction: Generalities I: Standardization of milk II: Milk coagulation III: Draining – pressing – salting
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IV: Refining the cheese
V: Some manufacturing defects
Chapter IV: Yogurt Technology
Introduction: Generalities
I: Definition
II: Manufacturing diagram
III: Manufacturing accidents
Chapter V: Butter Technology
Introduction: Generalities
I: Definition
II: Manufacturing diagram
III: Defects and alteration of butter
TP1: Physico-chemical study of milk
TP2: Butter production
TP3: Cheese production
TP4: Dairy factory visit

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> </table>	Written mid-term exam	10%
Written mid-term exam	10%		
	<table> <tr> <td>Practical works</td><td>20%</td></tr> </table>	Practical works	20%
Practical works	20%		
	<table> <tr> <td>Written final exam</td><td>70%</td></tr> </table>	Written final exam	70%
Written final exam	70%		
	<table> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>0%</td></tr> </table>	Quiz/QCM at the end of each main chapter	0%
Quiz/QCM at the end of each main chapter	0%		
Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/		
Reading list	▪ TECHNICAL SPECIFICATION FOR PUBLIC PURCHASE OF MILK AND MILK PRODUCTS STUDY GROUP OF CATERING AND NUTRITION MARKETS (GEM RCN) ▪ July 2009 Document downloadable from the site http://www.minefe.gouv.fr/directions_services/daj/guide/gpem/table.html		

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44. Science and technology of meat, fish and eggs				
Module Name	Science and technology of meat, fish and eggs			
Module level	3 rd year			
Code	UEF512			
Semester(s) in which the module is taught	Semester 5 (S5)			
Person responsible for the module	Mourad JRIDI			
Lecturer	Takoua BEN HLEL			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food industry & processing (FIP)	x		S5
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21 hrs	10-15 students
	Workshop			
	PW		17.5 hrs	10-15 students
Workload	Total	38.5 hrs	Self-study	37 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 UEF412 : Conservation techniques (or equivalent)			

Module Objectives	- Understanding the stages and phases of muscle transformation into meat is essential - Knowing the metabolic pathways involved in the transformation of muscle into meat is crucial. - Acquiring knowledge of various techniques for the production of meat products, seafood products, and egg products. - Gaining insight into the main methods of preserving meat and seafood products
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Learning outcomes	The student will be able to: - Determine the factors influencing the quality of meats. - Discern and identify the specific characteristics of high-quality meat - Demonstrate comprehensive knowledge of the main methods employed in the industrial-scale production of meat and seafood products. - Distinguish the various techniques utilized in the preservation of meat products, seafood products and egg products.
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Content	Chapter I: Meat products technologies - General introduction - Biological characteristics of meat muscle and meat products - Cutting and grinding - Chilled meat - frozen meat - Charcuterie products - Canned and semi-canned meat products - Frozen ready meals Chapter II: Seafood products technologies - Raw materials from fishing - Cold storage - Drying - Salting - Smoking - Canning Chapter III: from the egg to the egg products - The hen's egg - Chemical composition of the egg
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3. Physico-chemical properties of various egg fractions
4. Egg products industry

Practical work :

- **PW 1:** microbiological analysis of fish samples : fresh, frozen, and canned
- **PW 2:** Bacterial enumeration method on solid Media: Application and comparative analysis
- **PW 3:** Production of egg white powder
- **PW 4:** Study of the physicochemical characteristics of egg white powder
- **PW 5 :** Visit to El Mazraa company, a subsidiary of Poulina Group Holding (PGH) specializing in poultry farming and slaughter, as well as the processing and marketing of poultry products.

Activities conducted during the visit:

- Observation of the poultry slaughtering process.
- Understanding the standards and safety protocols in poultry slaughterhouses.
- Presentation of the poultry meat grinding process.
- Exploration of various stages in the production of frozen products and charcuterie.
- Understanding the importance of the cold chain.
- Presentation of modern equipment for preservation, freezing, and deep freezing.
- General discussion on poultry 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%
	Oral presentation 5%
Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	▪ Heinz, G., & Hautzinger, P. (2007). Meat processing technology for small to medium scale producers. RAP Publication (FAO), (2007). ▪ Toldrá, Fidel, ed. Handbook of meat processing. John Wiley & Sons, 2010. ▪ Collectif. (2017). "La Technologie de la Viande : Abattage et Transformation des Viandes de Boucherie." Édition 2017. Educagri. 16 October 2009. ▪ Huss, Food and Agriculture Organization of the United Nations. (1999). "Assurance de Qualité des Produits de la Mer." FAO. Paperback Book. Published on July 30, 1999

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45. Technology of fruits, vegetables and cereals

Module Name	Technology of fruits, vegetables and cereals			
Module level	3 rd year			
Code	UEF521			
Semester(s) in which the module is taught	Semester 5 (S5)			
Person responsible for the module	Ines ELLOUZE			
Lecturer	Hela Kchaou			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	Food industry & processing (FIP)	x		S5
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		14 hrs	10-15 students
	Workshop			
	PW		10.5 hrs	10-15 students
Workload	Total	24.5 hrs	Self-study	27 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 UEF 412 : Conservation techniques (or equivalent)			

Module Objectives

- Identification of the quality criteria for cereals, flours, and pasta.
- Comprehensive understanding of the wheat milling process stages.
- Exploration of technologies in the primary and secondary transformation of cereals.
- Knowledge of processing technologies for vegetables and fruits.

Learning outcomes

- The student will be able to:
- Understand the main components of cereals and their nutritional importance.
 - Differentiate between semolina milling and flour milling.
 - Identify high-quality cereals, flours, and pasta based on well-defined criteria.
 - Develop conceptual diagrams for the processing of products made from cereals, fruits, and vegetables.

Content

- Chapter I: Structure and physicochemical composition of cereals.**
- Chapter II: Economic and nutritional importance of cereals**
1. Evolution of production, demand and imports
 2. Physicochemical properties of cereal grains and their interconnection with processing
 3. Main constituents of cereal grains
- Chapter III: Storage and conservation of cereal grains**
1. Effect of moisture and temperature on cereal preservation
 2. Various forms of deterioration during storage
 3. Control and analysis of grains
- Chapter IV: Wheat milling and utilizations of end products**
1. Study of the wheat milling diagram
 2. Technology for the production of bakery products
 3. Technology for the production of "pasta" products
- Chapter V: Bread technology and biochemistry**
- Chapter VI: Fruits and vegetables: Pre-processing before industrial preservation.**
- Chapter VII: Fruit juice technology: preparation, processing, and preservation**
- **PW 1:** Production of fruit juice with different pasteurization Time-Temperature scales

- **PW 2:** Influence of the pasteurization Time-Temperature scale on the quality of fresh juice
- **PW 3:** Field trip (visit): to the Tunisian Milling Company (SMT) specialized in the production of flours, semolinas, barley products, and cereal derivatives, and to RANDA Company specialized in the processing of hard wheat into semolina, production of pasta, couscous, and barley derivatives.

Activities conducted during the visit:

- Familiarization with various wheat analysis techniques.
- Understanding the stages of the wheat milling process.
- Differentiation between semolina production and milling.
- Understanding the food production chain, from raw material sourcing to the distribution of finished products.
- Observation and understanding of advanced devices and equipment for pasta analysis.
- Learning methods for evaluating pasta quality (composition, texture, microbiological properties).
- Observation and assimilation of good hygiene practices.
- Study of the physicochemical characteristics of egg white powder

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	▪ Godon, B., & Loisel, W. (1997). Guide pratique d'analyse dans les industries des céréales. Paris: Technique et documentation - Lavoisier. ▪ Kaletunc, G., & Breslauer, K. J. (Eds.). (2003). Characterization of cereals and flours: properties, analysis and applications. CRC press. ▪ Maache Rezzoug, Z., Allaf, K., Bouvier, J. M., & Tayeb, J. (1998). Relations entre caractéristiques physiques et propriétés rhéologiques de la farine et de la pâte biscuitière. Sciences des Aliments (France), 18(3). ▪ Pareek, S. (2004). Fresh-cut fruits and vegetables: technology, physiology, and safety. Science, 71, S615-S620

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46. Fat Technologies

Module Name	Fat Technologies				
Module level	3rd year				
Code	UEF522				
Semester(s) in which the module is taught	Semester 5 (S5)				
Person responsible for the module	Ines ELLOUZE				
Lecturer	Haifa SEBII				
	Haifa SEBII				
Language	French				
Relation to curriculum	Program		Compulsory	elective	Semester
	Food Industries and Processing (IPA)		x		S5
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		14 H	10-20 students	
	workshop				
	PW		10.5 H	10-20 students	
Workload	Total		24.5	Self-Study	27 H
Credit points	2			Coefficient	1
Requirements according to the examination regulations	▪ Minimum attendance rate: 80% of planned contact hours An absenteeism rate > 20% = elimination of module exams				
Recommended prerequisites	▪ ECUF311 module: food biochemistry 1				

Module Objectives

- Know the major and minor constituents of fats
- Know the physical and chemical properties of fats
- Know the techniques for extracting seed oils and olive oil
- Know the factors of oil deterioration and their quality indicators
- Know the refining treatments for vegetable oils

Learning outcomes

- Determine the composition and physical properties of fats
- Establish storage and conservation conditions for seeds oil
- Optimize the conditions for extracting oils from seeds oil
- Being able to classify seeds oil according to their quality criteria
- Choosing the appropriate treatments to refine an oil
- Ensure the conservation of oils through the measurement of their quality indicators

Content

Chapter I: Composition of fatty substances
 I: Glycerides
 II: Unsaponifiable
 III: Other minor constituents
 Chapter II: Chemical properties of fatty substances
 I: Identification and assessment criteria
 II: Main chemical reactions
 Chapter III: Physical properties of fatty substances
 I: Crystal structure – polymorphism
 II: Main physical criteria
 Chapter IV: Seed oil mill
 Introduction: Generalities
 I: Preliminary steps
 II: Oil extraction
 III: Oil purification
 Chapter V: Olive technology

Introduction: Generalities
 I: Preliminary operations
 II: Preparing the dough
 III: Phase separation
 IV: Storage and preservation of oil
 V: By-products
 Chapter VI: Oil refining
 Introduction: Introduction
 I: Minor constituents and contaminants
 II: Basic chemical refining operations
 III: Physical refining
 Practical Work
 PW1: Extraction and physicochemical characterization of oils
 PW2: Visit to an oil mill

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> </table> Quiz/QCM at the end of each main chapter	Written mid-term exam	10%	Practical works	20%	Written final exam	70%
Written mid-term exam	10%						
Practical works	20%						
Written final exam	70%						
Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/						
Reading list	▪ COI/T.15/NC No. 3/Rev. June 12, 2018 FRENCH Original: FRENCH/ COMMERCIAL STANDARD APPLICABLE TO OLIVE OILS AND OLIVE POMACE OILS ▪ Course Constituents and Properties of Fatty Bodies Carried out by Ms. MADDI née SOUFI Ouahiba ▪ Vegetable oil technology book (French Edition)						

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47. Sugar and chocolate technologies					
Module Name	Sugar and chocolate technologies				
Module level	3rd year				
Code	UEF523				
Semester(s) in which the module is taught	Semester 5 (S5)				
Person responsible for the module	Ines ELLOUZE				
Lecturer	Hela KCHAOU				
	Hela KCHAOU				
Language	French				
Relation to curriculum	Program		Compulsory	Elective	Semester
	Food Industries and Processing (IPA)		x		S5
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		14 H	10-20 students	
	Workshop				
	PW		7 H	10-20 students	
Workload	Total		21 H	Self-learning	30 H
Credit points	2		Coefficient		1
Requirements according to the examination regulations	▪ Minimum attendance rate: 80% of planned contact hours An absenteeism rate > 20% = elimination of module exams				
Recommended prerequisites	▪ ECUEF311 module: food biochemistry 1				

Module Objectives	- Know the sugar production technology - Know the technology of cooked sugars - Know chocolate technology
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Learning outcomes	- Optimize raw material storage conditions - Choosing the appropriate sugar refining steps - Optimize cooking and sugar crystallization parameters - Establish a relationship between the manufacturing processes of cooked sugars and organoleptic defects - Choose the appropriate additives and optimize their doses according to their admissible daily doses according to the Codex Alimentarius
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Content	Chapter I: Sugar industry I: Beetroot II: Sugar technology Diffusion/Purification/clarification/filtration/Evaporation/Crystallization/Refining Mixing/turbining/Drying/conditioning Chapter II: Cooked sugars Introduction: Cooked Sugar Technology I: Cooking sugars I: Acidification / flavoring / coloring III: Manufacturing diagrams Chapter III: Chocolate industry I: Cocoa tree/cocoa bean II: Chocolate Technology II: Cocoa butter technology and substitutes Practical Work PW: Visit to a sugar industry
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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%
Media employed	Quiz/QCM at the end of each main chapter	
	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/	
Reading list	▪ Sugar technology - Dejonghe - beet sugar / Manufacturing of beet sugar ▪ Cocoa And Chocolate – Production, Use, Characteristics ▪ Cocoas and chocolates -Processing and manufacturing, engineering techniques	

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48. Quality-hygiene					
Module Name	Quality-Hygiene				
Module level	3rd year				
Code	UEF531				
Semester(s) in which the module is taught	Semester 5 (S5)				
Person responsible for the module	Ola ABDELHADI				
Lecturer	Hela Kchaou				
	Hela Kchaou				
Language	French				
Relation to curriculum	Program		Compulsory	Elective	Semester
	Food Industries and Processing (IPA)		x		S5
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		21 H	10-20 students	
	workshop				
	PW				
Workload	Total	21 H	Self-learning	55 H	
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	▪ UEO412: Food traceability				

Module Objectives	- Know the standards for food quality and safety management. - Know the HACCP program. - Know the different prerequisite programs to apply in the food industry.
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Learning outcomes	- Define and analyze the concept of food quality, including the identification of key quality chain operators and the principles of quality management. - Implement and manage control systems for food safety and quality, including the practical application of the HACCP program and understanding the benefits and processes of quality assurance system certification and audits.
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Content	Introduction: Quality of a food product: Definition and analysis of the concept Chapter I: Quality chain operators Chapter II: Quality management Chapter III: Statistical Process Control Chapter IV: Control of food safety and quality Historic I: Fundamental Characteristics II: Practical implementation IV: Application of the HACCP program Chapter V: Quality assurance system I: Establishment of the quality assurance system II: Quality Assurance System Certification -Audit III: Benefits of certification IV: HACCP and quality assurance system Introduction - Definition of food hygiene - Goals
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-The 5M
 Chapter I: Establishment, design and installation
 Introduction and objectives
 I: Location of the establishment
 II: Premises and rooms
 III: Material
 IV: Installation
 Chapter II: Staff hygiene
 Introduction :
 I: State of health
 II: Personal/Clothing cleanliness
 III: Staff behavior
 IV: Training
 Chapter III: Cleaning and disinfection
 Introduction: definitions
 I: Cleaning
 II: Cleaning studies
 III: Cleaning process
 IV: Disinfection
 V: Hygiene plan
 Chapter IV: Validation of cleaning and disinfection operations
 Introduction: Cleaning - disinfection plan
 I: Objectives of controlling cleaning - disinfection activity
 II: Technical Control
 III: Atmosphere Control
 Chapter V: Pest Control
 Introduction: Generalities
 I: Preventive measures
 II: Tracking and detection
 III: Eradication
 Chapter VII: Hygiene and HACCP

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows	
	Written mid-term exam	30%
	Written final exam	70%
Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/	
Reading list	NF EN ISO 9001/15 October 2015, Quality management systems — Requirements GENERAL PRINCIPLES OF FOOD HYGIENE/ CXC 1-1969: Codex Alimentarius INTERNATIONAL STANDARD ISO 22000 Second edition 2018-06 Food safety management systems — Requirements for any organization in the food chain	

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M.49 Conditioning and packaging				
Module Name	Conditioning and packaging			
Module level	3 rd year			
Code	UEF531			
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
	Food Quality Control (FQC)			
	Food industry & processing (FIP)	x		S3
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21 hrs	20-40 students
	Workshops		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 non attendance = elimination for exams			
Recommended prerequisites	- Physic (or equivalent) - Food Science (or equivalent)			

Module Objectives	- Define the necessary functions of packaging - List the different materials used in packaging - Understand the risks of contamination between packaging and contents
Learning outcomes	- Understand the properties of food packaging materials - Master the principles and the properties of packaging of food products - Differentiate between the different types of packaging : properties and roles in food preservation. Choose the appropriate packaging - Understand food labeling. - Apply critical thinking and food science principles to solve problems related to food packaging. - Be able to contribute to the development of new food packaging.

Content	CHAPTER I: Introduction - Definitions - Packaging functions CHAPTER II : Fundamentals of materials science - Intrinsic qualities of packaging - Mechanical properties - Thermal properties - Optical properties - Permeability CHAPTER III : Packaging functions - Passive protection role of packaging - Active protection role of packaging CHAPTER IV : Packaging and Marketing - Alerting function - Assignment function - Positioning functions
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4. Information function

5. Service function

CHAPTER V : Different packaging types

1. Primary packaging

2. Secondary packaging

3. Tertiary packaging

4. Quaternary packaging

CHAPTER VI : Packaging of food products

1. Food packaging definition

2. The functions of food packaging

CHAPTER VII : Packaging materials

1. Metallic materials

2. The glass

3. Plastic packaging

4. Cellulose materials

CHAPTER VIII : Product/packaging interaction

1. Permeation

2. Migration

3. Absorption or sorption

CHAPTER IX : Food labeling

1. Definition

2. Roles of labeling

3. Allegations

Practical work

- **PW1** : Identifying different types of packaging: visit to the SICAM industry
- **PW2** : Synthesis of a bioplastic film from different biopolymers

Workshops

- **WS 1**: Determine the properties of packaging materials (mechanical, permeability, thermal properties ...)
- **WS 2** : Study the advantages and limitations of packaging materials
- **WS 3** : Case study of some food labels

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%
Media employed	Questions at the end of each main chapter	
	0%	
Reading list	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	
	● Anon. 1980. Trends in packaging and distribution in the 1980's. ● International Fruit World 38 (207-208, 211, 213). ● Doyon, G. 1990. La conservation d'un aliment : les mécanismes de dégradation et le choix d'un emballage. Canadian Institute of Food Science and Technology Journal 23 (4/5): 165-170, 11	

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50. Sensory analysis				
Module Name	Sensory analysis			
Module level	3 rd year			
Code	UEO511			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Maissa KHEMAKHEM			
Lecturer	Maissa KHEMAKHEM			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food industry & processing (FIP)		x	S5
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	10-20 students	
	Workshop			
	PW	14 hrs	10-20 students	
Workload	Total	35 hrs	Self-study	15 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, Biochemistry, Microbiology, Food Technology and product quality			

Module Objectives	- Provide students with an in-depth understanding of the theoretical and practical principles of sensory analysis - Have the skills to plan, execute and interpret sensory tests in a variety of contexts - Show the importance of sensory analyses in research and development: validation of a process, a production method or a new recipe
Learning outcomes	- Understand the areas of application of sensory analysis. - Identify the actors who use sensory analysis and understand their role in the process. - Explain the relationship between sensation and stimulus. - Understand the physiological mechanisms of sensory perception - Recognize the essential characteristics of a measuring instrument. - Understanding the dispersion of results and its impact on interpretation - Acquire the necessary skills to form and lead a sensory analysis group. - Select the appropriate method for a given test. - Organise practical tests effectively. - Formulate relevant hypotheses in relation to the results of the tests. - Apply different types of tests (discriminative, descriptive, hedonic) depending on the specific objectives

Content	CHAPTER I: Introduction I. 1. Definition of sensory analysis I.2. Interests and uses of sensory analysis CHAPTER II: Sensory physiology II.1 Definitions II.1.1 Feeling II.1.2 Perception II.2 Physiological stages of perception II.2.1 Translation II.2.2 Information coding II.2.3 Integration
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II.3 The functioning of the senses

II.3.1 Vision

II.3.2 Hearing

II.3.3 Taste

II.3.4 Smell

II.3.5 Somesthesia

II.4 Trigeminal sensations

Chapter III Characteristics of a sensory response

III.1 Quality of a sensory response

III.2 Intensity of sensation and thresholds of perception

III.3 Hedonism

Chapter IV Sensory metrology

IV.1 Definition

IV.2 The subjective and the objective

IV.3 Characteristics of the measuring instrument

IV.3.1 Fidelity

IV.3.2 Accuracy

IV.3.3 Exactitude

IV.3.4 Sensitivity

IV.3.5 The human measuring instrument

Chapter V Sensory evaluation

V.1 Practical organization

V.1.1 Tasters

V.1.2 Formation of a panel

V.2 Duration of the session and workload

V.3 Presentation of samples

V.3.1 Sample anonymity

V.3.2 Coding of samples

V.3.3 Uniform presentation of samples

V.3.4 Method of presentation of samples

V.3.5 Order of presentation of samples

V.4 Staff

V.5 Taste rooms

V.5.1 The preparation room

V.5.2 The tasting room

V.5.3 The meeting room

V.6. Test conditions

Chapter VI Analysis of sensory data

VI.1 Classification of sensory quantities

VI.2 Assessment scales

VI.2.1 Category scales

VI.2.2 Interval scales

VI.2.3 Proportional (or ratio) scale

VI.3 Choice of test

VI.4 Sensory tests

VI.4.1 Discriminatory tests

VI.4.2 Descriptive tests

Practical Work

• **PW 1:** Organization and preparation of milk samples to carry out discriminative sensory analysis tests

• **PW 2:** Tasting of marketed reference olive oils: An extra virgin oil and an oil elected flavour of the year 2022 according to the method adopted by the National Oil Office (ONH)

• **PW 3:** Tasting a strong product: mustard using the duo-trio method

• **PW4:** Sensory analysis by smelling a lavender-based soap using the triangular method

• **PW 5:** Tasting of five yoghourts according to the intensity of vanilla flavour using the classification method

• **PW6:** Organization and preparation of samples of a flavoured oil to carry out a hedonic test

Study and examination requirements and forms of examination

Continuous control regime

The final score is weighted as follows:

Written mid-term exam 1	40%
Written mid-term exam 2	40%
Practical works	20%

Media employed	Digital presentations, Lab work manual and ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	▪ Meilgaard MC, Carr BT, Civille GV. Sensory Evaluation Techniques, Fourth Edition. CRC Press; 2006. 478 p. ▪ Lawless HT, Heymann H. Sensory Evaluation of Food: Principles and Practices. Springer Science & Business Media; 1999. 856 p.

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M50. Food Additives

Module Name	Food Additives			
Module level	3 rd year			
Code	UE0511			
Semester(s) in which the module is taught	Semester 5 (S5)			
Person responsible for the module	Ola ABDELHEDI			
Lecturer	Ola ABDELHEDI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food industry & processing (FIP)		x	S5
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	14h		
	PW		10-20 students	
Workload	Total	35 hrs	Self-study	15 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	Food biochemistry (or equivalent)			

Module Objectives

- Understand the concept of food additives and their regulation;
- Identify the different classes of food additives;
- Know the different types and the roles of food additives;
- Know the technical use, the limitation and the legal implications of food additives.

Learning outcomes

- The student will be able to:
- Distinguish the different types of food additives;
 - Classify food additives and explain their roles in foods;
 - Understand the limitations of using food additives;
 - Differentiate between food additives and processing aids;
 - Be able to consult adequate literature and information sources;
 - Be able to work efficiently on their own and as team members.

Content

Chapter I:

- Introduction
- Definitions and regulations of food additives
 - Role and importance of food additives
 - Food technology

Chapter II:

- Food colorants
- Preservatives
- Antioxidants

Chapter III:

- Emulsifiers
- Thickeners and gelling agents
- Other additives

Chapter IV:

- Processing Aids: Definition and role

Workshops:

WS 1: Case study of some foodstuffs rich in food additives

WS 2: Projects on different types of texturing agents

Practical work

- PW 1:** Extraction and determination of carotenoids.
- PW 2:** Sulfite determination in foods.

- **PW3:** Determination of the gelling and thickening role of Gum Arabic and starch.

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows:
	Written mid-term exam 40%
	Team work projects 40%
	Practical works 20%
Media employed	Digital presentations and Lab work manual are on the ISBB Extranet (https://isbb.rnu.tn/) for course material sharing
Reading list	

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M51. Soft drinks and juice technologies				
Module Name	Soft drinks and juice technologies			
Module level	3rd year			
Code	UEO512			
Semester(s) in which the module is taught	Semester 5 (S5)			
Person responsible for the module	Ines ELLOUZE			
Lecturer	Haifa SEBII			
	Haifa SEBII			
Language	French			
Relation to curriculum	Program	Compulsory	Elective	Semester
	Food Industries and Processing (IPA)		x	S5
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 H	10-20 students	
	Tutorial			
	Practical Work	14 H		
Workload	Total	35	Self-learning	15 H
Credit points	2	Coefficient	1	
Requirements according to the examination regulations	▪ Minimum attendance rate: 80% of planned contact hours An absenteeism rate > 20% = elimination of module exams			
Recommended prerequisites	▪ ECUEF311 module: food biochemistry 1			

Module Objectives	- Being able to distinguish between different types of beverages - Know the drinkable water standards - Know the principles of different beverage manufacturing technologies - Know the physicochemical properties of different types of drinks - Know the differences between drinks, juice, nectar and puree - Know the additives authorized in drinks and their admissible daily doses according to the Codex Alimentarius
Learning outcomes	- Understand and utilize the specific technologies and processes involved in the production of table waters, including purification methods, mineral adjustments, and quality control measures. - Integrate theoretical knowledge with practical experience by preparing and analyzing fruit juices and syrups, and by visiting a beverage manufacturing industry to observe real-world applications of water and beverage technology processes.

Content	CHAPTER I: Technology of natural mineral waters and table waters I. History and current status II. Regulations-Definitions III. Natural mineral water technologies IV. Table water technology CHAPTER II: Soft drink technology I. Definition of soft drinks II. Types and compositions of sparkling water III. Authorized additives IV. Diagram and steps of manufacturing of soft drinks CHAPTER III: Juice and nectar technology I. Fruit processing II. Juice Technology
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III.	Concentrated juice technology
IV.	Nectar Technology
v.	Puree technology
Practical work	
•PW1: Physico-chemical analysis of water	
•PW 2: Preparation and analysis of citrus juices and syrups- Goals	
• PW3: Visit to a beverage manufacturing industry	

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows:
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Written mid-term exam	40%
Written mid-term exam	40%
Practical works	20%
Quiz/QCM at the end of each main chapter	

Media employed	The course material and the practical work manual are available on the ISBB website: https://isbb.rnu.tn/
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Reading list	Drinking water treatment 1: Water quality and clarification/ Kader Gaid, University of Science and Technology of Algiers, Algeria Registered Tunisian Standard NT 09.14 (2013): Water intended for human consumption, excluding packaged water Guide to good hygienic practices for the fruit juice, nectars and derived products industry Carbonated Drinks: From the Food, Hygienic and Industrial Points of View (1867) Paperback – April 18, 2010
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M. Enology, brewery and Vinegar factory

Module Name	Enology, brewery and Vinegar factory			
Module level	3 rd year			
Code	UEO512			
Semester(s) in which the module is taught	Semester 5 (S5)			
Person responsible for the module	Haifa SEBII			
Lecturer	Haifa SEBII			
Language	French			
Relation to curriculum	Programme		Compulsory	Elective
	Food industry & processing (FIP)			x
Type of teaching, contact hours	Type of teaching		Contact hours	Class size
	Lecture		21 hrs	20-40 students
	Workshop			
	PW		14h	10-20 students
Workload	Total	35 hrs	Self-study	15 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	Food biochemistry (or equivalent)			

Module Objectives

- Understand the concept of food additives and their regulation;
- Identify the different classes of food additives;
- Know the different types and the roles of food additives;
- Know the technical use, the limitation and the legal implications of food additives.

Learning outcomes

- The student will be able to:
- Distinguish the different types of food additives;
 - Classify food additives and explain their roles in foods;
 - Understand the limitations of using food additives;
 - Differentiate between food additives and processing aids;
 - Be able to consult adequate literature and information sources;
 - Be able to work efficiently on their own and as team members.

Content

Chapter I: Enology

Introduction: The wine sector in Tunisia

Chapter I: Biochemical composition of grapes

Chapter II: Physicochemical and microbiological aspects of winemaking

Chapter III: Technological aspects of winemaking

Chapter IV: Quality, diseases, and accidents of wine

Chapter II: Brewery

Introduction: Definition

Chapter I: Raw materials

Chapter II: Malting

Chapter III: Beer production

Chapter III: Vinegar factory

Introduction: Definition, origin and evolution

Chapter I: Acetic bacteria

Chapter II: Industrial vinegar production

Chapter III: Properties and uses of vinegar

Workshops:

WS 1: Case study of some foodstuffs rich in food additives

WS 2: Projects on different types of texturing agents

Practical work

- PW 1:** Extraction and determination of carotenoids.

- **PW 2:** Sulfite determination in foods.
- **PW3:** Determination of the gelling and thickening role of Gum Arabic and starch.

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> </table>	Written mid-term exam 1	40%	Written mid-term exam 2	40%	Practical works	20%
Written mid-term exam 1	40%						
Written mid-term exam 2	40%						
Practical works	20%						
Media employed	Digital presentations and Lab work manual are on the ISBB Extranet (https://isbb.rnu.tn/) for course material sharing						
Reading list							

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52. AI Skills in Food Science and Management

Module Name	AI Skills in Food Science and Management				
Module level	3 rd year				
Code	ECUEF511				
Semester(s) in which the module is taught	Semester 5 (S5)				
Person responsible for the module	Mourad JRIDI				
Lecturer	Wael TAAMALI				
Language	English/French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	Food Quality Control (FQC)		x		S5
	Food industry & processing (FIP)		x		S5
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		14 hrs	20-40 students	
	Workshop				
	Project				
Workload	Total	14 hrs	Self-study	14 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	Food science and quality management				

Module Objectives	- Critically evaluate, select and responsibly implement AI-powered tools and solutions to address challenges in food safety, quality management, supply chain transparency, product development, and regulatory compliance - understand the ethical and practical limitations of AI systems.
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Intended learning outcomes	- Explain key AI concepts (machine learning, deep learning, NLP, computer vision) and their applications in the food industry - Identify and evaluate AI tools for food safety monitoring, hazard detection, and quality assurance - Apply predictive analytics and machine learning concepts to food safety risk assessment and contamination prediction - Understand the role of AI in traceability, supply chain transparency, and fraud detection - Critically assess ethical considerations, limitations, biases, and cybersecurity risks of AI systems in food applications - Addresses the challenges and benefits of AI in the food industry - Apply AI knowledge to real-world case studies and develop AI-powered decision support systems for food industry challenges
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Content	PART I: Foundations of AI in Food Systems CHAPTER I: Introduction to AI in Food Science Overview of AI, Machine Learning, and Deep Learning; Historical development of AI in food systems; Key AI concepts for food applications; Big data and AI in food science CHAPTER II: AI Technologies and Tools Supervised vs. unsupervised learning; Natural Language Processing (NLP) for food data analysis; Computer Vision applications in food quality monitoring; Data integration for comprehensive safety insights
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PART II: AI for Food Safety and Quality Management

CHAPTER I: AI in Food Safety Management

Role of AI in hazard identification; Predictive analytics for contamination control; AI algorithms for quality assurance; Machine vision for product inspection; Automated alerts and decision support; Challenges in AI model accuracy and training

CHAPTER II: AI and HACCP Integration

AI-assisted predictive contamination models; HACCP principles and AI integration; Real-time monitoring and early warning systems; Automated hazard detection and risk assessment

CHAPTER III: Digital Traceability Systems

Digital tools for supply chain transparency; Blockchain and AI for food provenance tracking; IoT sensors for real-time monitoring; Data collection and visualization techniques; Regulatory requirements for traceability; Reducing recall time through digital FSMS

PART III: AI in Food Manufacturing and Operations

CHAPTER I: Computer-Aided Production Management

Computer-aided food production process management; Process optimization and automation; Automated image and video analysis; Machine intelligence for knowledge association; Productivity enhancement through AI

Chapter II: AI for Quality Assurance, Inspection and Sensor Integration

Automated inspection systems; Pattern recognition in food quality data; AI-enabled real-time inspection techniques; Automated detection of food defects and contaminants

Integrating sensor data into AI decision-making models; Environmental monitoring for safety compliance; Connected food safety systems

PART IV: AI for Food Fraud, Crisis Management and Ethics

CHAPTER I: AI in Food Fraud Detection

Types of food fraud and their impact on safety; AI tools for detecting fraudulent practices; Analyzing supply chain data for fraud indicators; Preventive strategies using predictive modeling; AI and blockchain integration

CHAPTER II: AI in Food Fraud Detection

AI support in food safety emergency response; Predicting and containing safety incidents; Decision support systems for rapid action; Post-crisis analysis using AI insights

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows:	
	Written mid-term exam 1	50%
	Written mid-term exam 2	50%
	Practical works	0%
	Written final exam	0%
	Quiz/QCM at the end of each main chapter	0%
Media employed	Digital presentations are available on ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	
Reading list	▪ Sarkar, T., & Haldorai, A. (Eds.). (2025). Artificial Intelligence in Food Science. ISBN: 9780443246489 ▪ EIT Food. NPD Skills Training: AI for Functional Food Development, Sensory Evaluation & AI (course materials) ▪ Lebanese American University. NUT625 Artificial Intelligence in Nutrition and Food Science (course materials) ▪ The Knowledge Academy. AI Certification in Food Safety Course (course materials)	

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53. Entrepreneurship					
Module Name	Entrepreneurship				
Module level	3 rd year				
Code	ECUEF511				
Semester(s) in which the module is taught	Semester 5 (S5)				
Person responsible for the module	Lobna Essid				
Lecturer	Amira Lamouchi				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	Food Quality Control (FQC)		x		S5
	Food industry & processing (FIP)		x		S5
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		hrs	20-40 students	
	Workshop		21 hrs	10-20 students	
	Project		hrs	10-20 students	
Workload	Total	21hrs	Self-study	30 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					

Module Objectives	- Develop an entrepreneurial mindset and understand the core traits of successful entrepreneurs. - Identify and evaluate viable business ideas and opportunities based on market trends and consumer needs. - Understand and organize key business resources, including legal, human, material, and marketing components. - Plan and assess financial strategies for launching and sustaining a business venture. - Develop and present a comprehensive business plan that integrates all functional areas of entrepreneurship.
Intended learning outcomes	- Explain the key characteristics of an entrepreneurial mindset and its role in identifying customer needs and satisfaction. - Identify and evaluate business opportunities using insights from economic and social trends, and apply market research tools. - Demonstrate knowledge of legal, human, and material resource requirements for launching a new business. - Develop a structured production and marketing plan for a new product or service. - Identify and compare financial strategies and sources of funding for startups. - Prepare a complete business plan that includes marketing, financial, and operational components. - Critically review and revise a business plan based on feedback and evaluation criteria.
Content	Unit I: The Entrepreneurial Mindset - Activity 1.1: Understanding the Entrepreneurial Spirit - Activity 1.2: Customer Satisfaction Unit II: Business Ideas and Opportunities - Activity 2.1: Business Ideas and Opportunities - Activity 2.2: Economic and Social Trends - Activity 2.3: Market Research Simulation

Unit III: Organizing Resources

- Activity 3.1: Legal Requirements
- Activity 3.2: Human and Material Resources
- Activity 3.3: Production Plan
- Activity 3.4: Marketing Plan
- Activity 3.5: Developing the Marketing Plan for a New Product

Unit IV: Financial Planning

- Activity 4.1: Financial Strategies
- Activity 4.2: Financing Options

Unit V: Business Plan

- Activity 5.1: Purpose of a Business Plan
- Activity 5.2: Developing a Business Plan
- Activity 5.3: Evaluating and Revising a Business Plan

Study and examination requirements and forms of examination

Mixed evaluation

The final score is weighted as follows:

Written mid-term exams	50%
	50%
Practical works	0%
Written final exam	0%
Quiz/QCM at the end of each main chapter	0%

Media employed

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Reading list

- Hisrich, R.D., Peters, M.P., & Shepherd, D.A. (2020). *Entrepreneurship*. 11th Edition. McGraw-Hill Education.
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M54. Biostatistics I and bioinformatics I					
Module Name	Biostatistics I and bioinformatics I				
Module level	3 nd year				
Code	UET513				
Semester(s) in which the module is taught	Semester 5 (S5)				
Person responsible for the module	Wael TAAMALLI				
Lecturer	Wael TAAMALLI				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	Food Quality Control (FQC)		x		S5
	Food industry & processing (FIP)		x		S5
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		0 hrs	20-40 students	
	Workshop		21 hrs	10-20 students	
	PW		0 hrs	10-20 students	
Workload	Total		21 hrs	Self-study	05 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	Module UEF111: Applied mathematics				

Module Objectives	To equip students with the ability to perform and interpret statistical tests, such as hypothesis tests for comparing means, ANOVA, and tests for correlation and independence. To develop students' skills in data visualization and representation by graphical and numerical methods to summarize and interpret datasets. To provide a comprehensive understanding of biological sequence data and their associated databases To equip students with skills in sequence alignment techniques To introduce homology search methods and their applications To enable practical application of bioinformatics tools and databases
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Learning outcomes	The students will be able to: - Understand the assumptions and applications of statistical tests (t-tests, ANOVA, chi-square, correlation). - Organize and represent data using appropriate graphs and summary statistics. - Select and perform appropriate hypothesis tests using statistical software. - Demonstrate an understanding of the structure and contents of key bioinformatics databases, such as NCBI and UniProt. - Effectively query and extract information from these databases. - Apply various sequence alignment methods, evaluate and interpret alignment results - Conduct homology searches using the BLAST algorithm for both protein and nucleotide sequences, and interpret the statistical results - Recognize ethical considerations in data collection, analysis, and interpretation.
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Content	Chapter 1: general introduction Chapter 2: data representation Chapter 3: central tendency and dispersion parameters Chapter 4: tests for comparing means Chapter 5: analysis of variance Chapter 6: correlation, independence, and fit
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Chapter 7: introduction to bioinformatics

1. History of bioinformatics
2. Overview of the central dogma of molecular biology

Chapter 8: sequence data structure and databases

1. The ncbi data model
2. The uniprot data model
3. Specialized databases

Chapter 9: sequence homology studies and alignment methods

1. Pairwise sequence alignment
2. Multiple sequence alignment
3. Homology search methods

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows:	
	Two written mid-term exam	100%
	Practical works	0%
	Written final exam	0%
	Guided problems	0%
Media employed	Practical sessions are conducted in a computer lab. Exercises are solved using specialized software	
Reading list	▪ Pascal Staccini. (2013). Multiple Choice Questions (MCQs) in Biostatistics: (Course Review, MCQs, and Solved Exercises, Comments and advice from the instructor) Book. Ellipses, Paris 2013, ISBN: 9782729883652C. ▪ Gilbert Deléage, Manolo Gouy. (2015). Bioinformatics: Course and Applications Dunod, Paris 2015, ISBN: 9782100727520	

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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
	Food Quality Control (FQC)	x		
	Food industry & processing (FIP)	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 the real-world food industry environment. ▪ Familiarize them with company operations, organizational structure, and work culture. ▪ Build early professional attitudes and basic communication skills. ▪ Provide a first exposure to industrial workflows through observation and basic participation.
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Learning outcomes	By the end of this internship, students will be able to: ▪ Understand the expectations and objectives of the assigned internship mission ▪ Describe the industrial organization of a food company ▪ Observe standard operating procedures and hygiene practices ▪ Demonstrate professional behavior (punctuality, attendance, conduct, respect) ▪ Communicate effectively in a professional environment ▪ Present information in a structured written format
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Content	- Introduction to the company: structure, departments, and industrial environment - Observation of production workflows and hygienic practices - Professional communication, workplace safety - Reflective observation on the socio-economic and organizational context - Preparation of a short descriptive report summarizing internship experience
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Study and examination requirements and forms of examination	Students need to present an internship report to the Internship Director.
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Media employed	
Reading list	internship notebook

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B. Internship in the food industry				
Module Name	Internship in the food industry			
Module level	2sd year			
Code				
Semester(s) in which the module is taught	At the end of semester 4 (1 month in summer vacation)			
Person responsible for the module	Internship Director			
Lecturer				
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		
	Food industry & processing (FIP)	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	▪ Deepen understanding of food science applications in an industrial context. ▪ Apply academic knowledge to real-world challenges under supervision. ▪ Engage in a defined project or task related to food production or quality control. ▪ Develop technical reporting and workplace communication skills.
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Learning outcomes	By the end of this internship, students will be able to: ▪ Apply scientific and technical knowledge in a real-world industrial context ▪ Write a clear, structured, and technically sound report ▪ Analyze observations or technical data from the field ▪ Work effectively as part of a professional team ▪ Propose simple improvements or solutions to encountered issues ▪ Communicate with professionals both orally and in writing ▪ Deliver a clear and structured oral presentation of technical work
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Content	- Company induction and review of industrial practices in food science - Assignment to a real-world technical operational issue - Application of classroom knowledge in real world setting - Data collection, process analysis, or quality assessment under company supervision - Active participation in team meetings, reporting, and task planning - Documentation of findings in a internship report
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Study and examination requirements and forms of examination	Student need to present an internship report to the Internship Director.
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Media employed	
Reading list	internship notebook

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C. Graduation research project internship

Module Name	Graduation research project internship			
Module level	3 ^d year			
Code				
Semester(s) in which the module is taught	S6			
Person responsible for the module	Internship Director			
Lecturer				
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		6
	Food industry & processing (FIP)	x		6
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	750 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

- Conduct a final year project aligned with company needs and academic learning.
- Develop autonomy in problem-solving, project planning, and execution.
- Strengthen competencies in data collection, analysis, and technical reporting.
- Synthesize academic and practical experiences into a final year project thesis.

Learning outcomes

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

- Identify and formulate a real-world issue in the food sector.
- Locate, analyze and synthesize information from various sources and use it to propose solutions within one's field of activity
- Analyze and interpret data to support project conclusions.
- Apply principles of discipline in practical, real-world situations and problems.
- Select appropriate techniques, methods when presented with a practical problem
- Manage project planning, execution and follow-up with minimal supervision.
- Present written results in a clear, structured format that complies with academic standards.
- Deliver oral presentations that are clear, well-structured and consistent with the written report.
- Communicate effectively with diverse audiences, while demonstrating professional behavior.
- Demonstrate initiative, adaptability, and critical thinking.
- Collaborate effectively with the company team and academic supervisor.

Content

- Definition of a final year project aligned with company objectives and student expertise
- Autonomous management of project scope, planning, and execution under supervision
- Data collection, experimentation and analysis
- Application of scientific and technical knowledge in a professional setting
- Preparation of a comprehensive thesis

- Oral presentation of project results to academic and industry panels
- Evaluation by both institutional and company supervisors

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