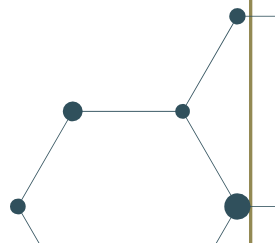


B.S. in Food Science and
Technology, Food Quality
Control Option programme

FQC

MODULE HANDBOOK



 INSTITUT SUPÉRIEUR DE BIOTECHNOLOGIE DE BÉJA المعهد العالي للتكنولوجيا ببجاية	Module Handbook Food Quality Control (FQC)	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	<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	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.
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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.
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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.
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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%
Media employed	Quiz/QCM at the end of each main chapter	0%
	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	Houssem JABRI				
Lecturer	Houssem 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 dioptr, 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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03. 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

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

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.

- **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
- 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: <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	▪ 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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05. 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 BOURAQUI			
Lecturer	Yosra BOURAQUI			
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	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 transport
- 2.1.1. Simple diffusion
- 2.1.2. passive transport
- 2.1.3. active transport
- 2.2. Endocytosis and penetration of cells 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. Nucleole
- 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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06. 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.

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.

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**
 - 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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07. 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				
Lecturer	Mohamed MENDILI				
Language	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.

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.

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**
 - 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

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 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.

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		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		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

- Position of the Animal Kingdom within living organisms
- Diversity and evolution of the animal world
- 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
- 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:	
	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	

- **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.

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.

Content

Unit I: What is Science

1. Getting started in research: Having a career in science
2. Branches of science
3. Word formation: dictionary use for scientific purposes
4. Prefixes and suffixes for scientific use

Unit II: Introduction to scientific vocabulary

1. Etymology of words
2. Grammar: Simple Past Vs. Present perfect
3. Materials Science Vs Materials Engineering
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%
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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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.

- 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

-
- 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	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		
	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 I. Fatty acids
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- 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 main chapter	0%

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	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	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.
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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.
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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
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- **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> <tr> <td data-bbox="418 703 925 734">Written mid-term exam</td><td data-bbox="925 703 1453 734">5%</td></tr> </table>	Written mid-term exam	5%
Written mid-term exam	5%		
	<table> <tr> <td data-bbox="418 734 925 766">Practical works</td><td data-bbox="925 734 1453 766">20%</td></tr> </table>	Practical works	20%
Practical works	20%		
	<table> <tr> <td data-bbox="418 766 925 797">Written final exam</td><td data-bbox="925 766 1453 797">70%</td></tr> </table>	Written final exam	70%
Written final exam	70%		
	<table> <tr> <td data-bbox="418 797 925 828">Quiz/QCM at the end of each main chapter</td><td data-bbox="925 797 1453 828">5%</td></tr> </table>	Quiz/QCM at the end of each main chapter	5%
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. III. Different types of RNA (mRNA, tRNA, rRNA)
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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: <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	▪ 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 éme 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.

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

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

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: <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	▪ 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-Gourgaud, 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.
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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.
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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: <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
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. Développent, 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, 4ème 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	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	Food Quality Control (FCQ)	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.
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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.
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Content	Chapter 1: Internal Environment and Homeostasis - Body Fluid Compartments - Definition and characteristics of the internal environment - Classification of body fluid compartments - Volume of body fluid components
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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: <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	▪ 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	<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	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

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

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

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

Written mid-term exam	80%
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Presentations	20%
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Quiz/QCM at the end of each main chapter	0%
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Media employed	The course materials are available on the ISBB website : https://isbb.rnu.tn/
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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:
	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 GHOUZI			
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.
Learning outcomes	- Identify the different economic agents. - Learn the different types of economic relationships. - Represent a simplified economic circuit between different economic agents.
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. 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 GHOUZI				
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

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: <table> <tr> <td>Written mid-term exam 1</td><td>50%</td></tr> <tr> <td>Written mid-term exam 2</td><td>50%</td></tr> <tr> <td>Written final exam</td><td>00%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>00%</td></tr> </table>	Written mid-term exam 1	50%	Written mid-term exam 2	50%	Written final exam	00%	Quiz/QCM at the end of each main chapter	00%
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:	
	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
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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.

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.

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
- 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:
	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	<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			
	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.

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

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
- 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

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

Content

CHAPTER I: Transfer of momentum or fluid mechanics

- Deformation of a fluid
- Hydrostatic (fluid at rest)
- Application: Pressure gauges
- Hydrodynamics (fluid in motion)

- Fundamental equations
- Load losses

CHAPTER II: Heat transfer

- Different modes of heat transfer
 - Heat transfer by conduction
 - Heat transfer by convection
 - Heat transfer by radiation
- Energy conservation assessments

Unidirectional conduction in steady state: Example of a composite wall

- Rectangular coordinates
- Cylindrical coordinates

CHAPTER III: mass transfer

- Transfer of mass by diffusion
 - Molecular diffusion in liquid media

- 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 ALIMI			
Lecturer	Dhouha ALIMI			
	YOSRA MESSOUDI			
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	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 - 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:	
	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.

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

Content

Chapter 1: Basic notions of Toxicology

1. Generality
2. The fate of toxic substances
3. Assessment of Toxicity: the different doses and their effects
4. Dose/time and dose/effect relationships
5. Toxicokinetics and Toxicodynamics

Chapter 2: Food toxicology

1. The mechanisms of action of a toxicant
2. Cytotoxicity
3. Genotoxicity

Chapter 3. Food contaminants

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: <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	▪ 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	<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	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

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

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.

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
 - 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
- **PW1:** Biological foods from plant 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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29. Physical properties of food

Module Name	Physical properties of food			
Module level	2nd year			
Code	UEO311			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Haifa SEBII			
Lecturer	Haifa SEBII			
Language	French			
Relation to curriculum	Program	<i>compulsory</i>	Elective	Semester
	Food Quality Control		x	S3
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 H	30-50 students	
	Workshop	7H		
	PW	0H	10-20 students	
Workload	Total	28	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	ECUEF311 module: food biochemistry 1			

Module Objectives

- Explain the role of physical properties in food manufacturing, storage, handling, and sensory quality.
- Select appropriate instruments and methods to measure different physical properties of food materials (e.g., Texture Analyzer, Viscometer, Colorimeter, Differential Scanning Calorimeter (DSC)).

Learning outcomes

- Describe and explain the fundamental physical properties of food materials (e.g., texture, density, rheology, thermal and optical properties).
- Understand the principles behind measurement techniques used for evaluating physical properties in food systems.
- Recognize the impact of food composition and structure on its physical behavior.
- Use laboratory instruments such as texture analyzers, viscometers, colorimeters, and thermal analysis equipment to measure food physical properties.
- Conduct experiments and report on the physical characteristics of different food products.
- Calculate physical parameters such as density, porosity, viscosity, and thermal conductivity from raw experimental data.

Content

Introduction to Physical Properties of Food

- Importance in food industry
- Classification of physical properties (mechanical, thermal, rheological, etc.)

Chap1: Food Texture and Mechanical Properties

- Texture parameters (hardness, crispness, chewiness)
- Texture profile analysis (TPA)
- Sensory vs instrumental texture measurement

Chap2: Rheological Properties of Foods

- Viscosity and flow behavior
- Newtonian and Non-Newtonian fluids
- Models: Power Law, Bingham Plastic

Chap3: Density and Porosity of Foods

- Bulk density, true density
- Porosity and its significance in drying, packaging

Chap4: Thermal Properties of Foods

- Specific heat, thermal conductivity, thermal diffusivity
- Applications in cooking, freezing, and drying processes

Chap5: Water Activity and Moisture Content

- Importance in food preservation
- Methods of measurement

Optical Properties of Foods

- Color measurement (Lab* system)
- Transparency, turbidity

Chap6: Surface and Interfacial Properties

- Surface tension, wetting, adhesion
- Applications in emulsions and coatings

Chap7: Applications in Food Industry and Quality Control

- Quality control parameters
- Case studies from food processing industry

Student Presentations and Module Review

- Group presentations on selected foods and their physical properties

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	Figura, L. O., & Teixeira, A. A. (2007). Food Physics: Physical Properties - Measurement and Applications. Springer. Bourne, M. C. (2002). Food Texture and Viscosity: Concept and Measurement. Academic Press.								

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30. Biowaste valorization

Module Name	Biowaste valorization			
Module level	2 nd year			
Code	UEO312			
Semester(s) in which the module is taught	Semester 3 (S3)			
Person responsible for the module	Wisseem bhour			
Lecturer	Wisseem 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.

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.

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
- 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 border="1"> <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. Food fraud				
Module Name	Food fraud			
Module level	2 nd level			
Code	UEO312			
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 Quality Control (FQC)		X	
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	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 fundamental issues related to food fraud, including its definitions, typologies, and its economic, health, and social impacts. - Identify and analyze the various forms of food fraud, along with the associated risks to public health and the integrity of the food supply chain. - Master the basic principles of detection methods and analytical tools used to prevent, detect, and manage food fraud. - Understand national and international regulatory frameworks governing the fight against food fraud, and the role of institutions in prevention and collaboration.
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Learning outcomes	- Define and explain key concepts related to food fraud, including its forms, causes, and economic, health, and legal consequences. - Identify the different types of food fraud and classify them according to functional, technical, or regulatory criteria. - Analyze the risks associated with food fraud, considering impacts on public health, the supply chain, and consumer perception. - Apply basic analytical methods (e.g., spectroscopy, DNA analysis, chromatography) to understand food product detection and authentication processes. - Interpret national and international regulations related to the prevention, detection, and management of food fraud. - Propose preventive or control actions adapted to professional contexts, using appropriate regulatory, scientific, and strategic tools.
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Content	Chapter 1. General Introduction to Food Fraud 1. Definition and distinction from non-compliance
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2. Presentation of food fraud as a major global challenge

3. Economic, health, and social consequences

Chapter 2 – Terminology Related to Food Fraud

1. Food authenticity

2. Food integrity

3. Food crime

4. Traceability

5. Falsification

Chapter 3. Types of Food Fraud

1. Adulteration

2. Falsification

3. Expiry date fraud

4. Theft

5. Diversion

6. Simulation

7. Counterfeiting

Chapter 4. Health Risks and Consumer Perception

1. Food adulteration

2. Chemical contamination

3. Bacterial contamination

4. Misuse of food additives

5. Consumer expectations and reactions

Chapter 5. Detection Methods and Scientific Tools

1. Targeted and non-targeted methods

2. Applications of analytical tests: effectiveness, limitations, and developments

3. Development and standardization of new methods

4. Risk-based detection and prioritization

Chapter 6. Prevention Strategies and Collaboration

1. Prevention as the first line of defense against food fraud

2. Intelligence gathering to anticipate and prevent fraud

Chapter 7. Regulatory Frameworks and Institutional Initiatives

1. National and international regulatory frameworks

2. Regulation as a tool for prevention and mitigation

3. Measures by the U.S. Food and Drug Administration (FDA)

4. Regulatory support for proactive risk management

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 and Case Studies	
Reading list	• Rosalee S. Hellberg, Karen Everstine, Steven A. Sklare (2020). Food Fraud: A Global Threat with Public Health and Economic Consequences. • John W. Spink. 2019. Food Fraud Prevention: Introduction, Implementation, and Management.	

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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	<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			
	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.

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.

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?
 - 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".

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

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

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	30%
	Practical works	0%
	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	<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	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.

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.

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

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.

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.).

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

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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36. 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	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	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	<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	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..

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.

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

-
- 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
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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	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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38. 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 SEBIL			
Lecturer	Haifa SEBIL			
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	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.

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.

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

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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39. 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			
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. - Snowball sampling.
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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:
	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/

 INSTITUT SUPÉRIEUR DE BIOTECHNOLOGIE DE GUELMA المعهد العالي للتكنولوجيا البيوتكنولوجية	Module Handbook Food Quality control (FQC)	ENR-CD-06 06/02/2023
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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
 - 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> <tr> <td>Written mid-term exam</td><td>40%</td></tr> </table>	Written mid-term exam	40%
Written mid-term exam	40%		
	<table> <tr> <td>Written mid-term exam</td><td>40%</td></tr> </table>	Written mid-term exam	40%
Written mid-term exam	40%		
	<table> <tr> <td>Practical works</td><td>20%</td></tr> </table>	Practical works	20%
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.

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.

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
- 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:	
	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
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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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40. Food Safety Management System

Module Name	Food Safety Management System				
Module level	2 nd year				
Code	UEO412				
Semester(s) in which the module is taught	Semester 4 (S4)				
Person responsible for the module	Maissa Khemakhem				
Lecturer	bassem FADHLAUI				
Language	French				
Relation to curriculum	Programme	Compulsory	Elective	Semester	
	Food Quality Control (FQC)		X		
Type of teaching, contact hours	Type of teaching	Contact hours	Class size		
	Lecture	21hrs	20-40 students		
	Workshop	7hrs	20-40 students		
	PW	10.5h			
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	Quality control management				

Module Objectives

- Introduce students to the importance of food safety in the food supply chain.
- Provide a comprehensive understanding of international food safety standards and regulatory frameworks.
- Enhance students' competencies in monitoring, documentation, and corrective actions to maintain and improve food safety systems.
- Foster critical thinking about continuous improvement and management of non-conformities within food safety systems.
- Prepare students to collaborate effectively within multidisciplinary teams to ensure food safety compliance in various food industry settings.

Learning outcomes

- Explain the fundamental concepts of food safety
- Identify food safety risks and understand how they are controlled in a food business
- Describe the main international food safety standards and frameworks (Codex Alimentarius, ISO 22000, FSSC 22000, BRCGS, IFS, GLOBALG.A.P.).
- Identify the roles and responsibilities of stakeholders across the food chain in ensuring food safety.
- Understand the basics of the HACCP system and prerequisite programs (PRPs).
- Analyze food safety risks and propose appropriate control measures.
- Implement FSMS principles in real or simulated case studies.
- Establish corrective action procedures
- Monitor procedures and maintain records
- Collaborate effectively within a food safety or quality team to ensure compliance with regulatory and standard requirements.

Content

- Chapter 1. Introduction to Food Safety**
 - Definition
 - Business Value of Food Safety Management Systems
 - Stakeholders in Food Safety Management Systems
 - Food hazards (biological, chemical and physical)
 - Traceability and Risk Analysis
- Chapter 2. Regulatory and Standards Frameworks**

1. Codex Alimentarius
 2. ISO Standards & FSSC 22000
 3. BRC Global Standards (BRCGS)
 4. International Featured Standard (IFS)
 5. Global G.A.P
- **Chapter 3. Principles of Management of Food Safety**
 - **Chapter 4. Key Elements of FSMS**
 1. Interactive communication
 2. System management
 3. Prerequisite programs (PRPs)
 4. HACCP principles
 - **Chapter 5. Implementation of the FSMS**
 - **Chapter 6. Food Safety system certification 22000**
 - **Chapter 7. Continual Improvement and management of non-conformities**

Study and examination requirements and forms of examination	CONTINUOUS MONITORING The final score is weighted as follows:		
	<table> <tr> <td>Written mid-term exam 1</td><td>50%</td></tr> </table>	Written mid-term exam 1	50%
Written mid-term exam 1	50%		
	<table> <tr> <td>Written mid-term exam 2</td><td>50%</td></tr> </table>	Written mid-term exam 2	50%
Written mid-term exam 2	50%		
	<table> <tr> <td>Written final exam</td><td>00%</td></tr> </table>	Written final exam	00%
Written final exam	00%		
	<table> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>00%</td></tr> </table>	Quiz/QCM at the end of each main chapter	00%
Quiz/QCM at the end of each main chapter	00%		
Media employed	Course material, Practical Applications and Case Studies		
Reading list	▪ Boutou, O. (2014). De l'HACCP à l'ISO 22000 : management de la sécurité des aliments (3e éd.). AFNOR Éditions. ▪ Abu Al-Rub, Fahmi, <i>Food Safety Management Systems</i>. GAVIN eBooks (GAVIN Conferences & Publishers), juin 2020. ISBN 978-1-951814-02-1. ▪ ISO 22000:2018 – Food Safety Management Systems – Requirements for any organization in the food chain.		

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40. Halal management					
Module Name	Halal management				
Module level	2 nd year				
Code	UEO412				
Semester(s) in which the module is taught	Semester (S4)				
Person responsible for the module	Maissa Khemakhem				
Lecturer	Oumaima Ben Arbi				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	Food Quality Control (FQC)			X	
Type of teaching, contact hours	Type of teaching		Contact hours	Class size	
	Lecture		21hrs	20-40 students	
	Workshop		7hrs	20-40 students	
	PW		10.5H		
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	Food Safety management System, HACCP system				

Module Objectives	- Understand the international regulatory requirements related to Halal products and Halal food production standards. - Develop a solid understanding of the fundamental principles of food safety applied to Halal products, including the Tayyib principles. - Acquire Specialized knowledge on the Fiqh, sanitary, and ethical requirements applicable to Halal food production. - Integrate best practices in animal welfare and slaughtering methods compliant with Halal requirements. - Develop skills in auditing, inspection, and conformity assessment of Halal products according to international and religious standards.
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Learning outcomes	- Apply international regulatory and normative requirements for Halal food production and certification. - Implement food safety principles and Tayyib requirements in daily Halal production operations. - Perform basic controls and participate in Halal compliance inspections under supervision. - Use laboratory test results to verify the conformity of Halal products according to established procedures. - Recognize best practices in animal welfare and their importance in the Halal process. - Prepare clear and accurate inspection or compliance reports to support Halal certification activities.
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Content	Chapter 1: Halal Regulations requirements and Halal Food Production standards 1- A Benchmarking on International Halal Food Standards
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- 2- Food Production, International Legislation, and Halal Requirements :
- 2.1. Processed Meat
- 2.2. Food Additives, Enzymes, Processing aids, Flavorings
- 2.3. Beverages, Soy Sauce and Vinegar
- 2.4. Genetically modified organisms (GMOs)
- 2.5. Dairy products

Chapter 2: Halal Tayyib principals in relation to Food Safety and Food Safety Management Systems

- 1- Risk Assessment Principals
- 2- Halal Food Inspection and traceability
- 3- Food Safety Management Systems auditing and certification

Chapter 3. Animal Welfare and Halal Slaughtering Requirements

- 1- Animal Welfare on Farm, Transportation and Slaughterhouses
- 2- Slaughterhouse Inspections
- 3- Slaughterhouse Hygiene and Food Safety Requirements
- 4- Animal Stunning Methods
- 5- Slaughtering Methods in meat animals and poultry
- 6- Slaughterhouse remote Visit

Chapter 4. Halal Products Characteristics including Testing Techniques

- 1- Use of laboratory testing in Halal food production and Halal food certification and Inspection.
- 2- Molecular and Microbiological tests in food and food production

Chapter 5. Halal Products Conformity Assessment and International Certification Schemes

- 1- Halal Certification schemes
- 2- Suitability of Halal certification schemes

Chapter 6. Halal Products Fiqh Requirements

Chapter 7. Halal Audit, Inspection, Accreditation and Recognition

- 1- Auditing Techniques
- 2- Internal Audit (IA)
- 3- Halal Accreditation Bodies
- 4- Integrated Halal Accreditation System

Study and examination requirements and forms of examination	CONTINUOUS MONITORING The final score is weighted as follows: <table border="1"> <tr> <td>Written mid-term exam 1</td><td>50%</td></tr> <tr> <td>Written mid-term exam 2</td><td>50%</td></tr> <tr> <td>Written final exam</td><td>00%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>00%</td></tr> </table>	Written mid-term exam 1	50%	Written mid-term exam 2	50%	Written final exam	00%	Quiz/QCM at the end of each main chapter	00%
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, Practical Applications and Case Studies, On-Site Slaughterhouse Visit								
Reading list	Mian N. Riaz, Muhammad M. Chaudry.2003. Halal food production								

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40. ISO/IEC 17025:2017 – Laboratory management systems

Module Name	ISO/IEC 17025:2017 – Laboratory management systems				
Module level	2 nd year				
Code	UEO412				
Semester(s) in which the module is taught	Semester 4 (S4)				
Person responsible for the module	Wael TAAMALLI				
Lecturer					
Language	English				
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 Objectives

- Explain the structure, purpose, and scope of ISO/IEC 17025:2017 and its role in ensuring laboratory competence and reliable testing/calibration results.
- Identify and interpret the key clauses and requirements of ISO/IEC 17025:2017, including general, structural, resource, process, and management system requirements.
- Apply essential principles of laboratory process management, including contract review, method validation, sampling, handling, technical records, result validity, and reporting.
- Analyze and manage laboratory information systems, customer complaints, nonconformities, and implement appropriate corrective actions.
- Evaluate conformity with ISO/IEC 17025:2017 through documentation review, internal audits, and risk-based thinking approaches.
- Demonstrate an understanding of accreditation processes and how testing laboratories can prepare for, achieve, and maintain accreditation under ISO/IEC 17025:2017.

Learning outcomes

The student will be able to:

- Define the aims and objectives of ISO/IEC 17025:2017
- Discuss the benefits of ISO/IEC 17025:2017 accreditation
- Recognise the verbal forms used throughout ISO/IEC 17025:2017
- Summarise the four main sections of ISO/IEC 17027:2017
- Separate the requirements of impartiality from the requirements of confidentiality in ISO/IEC 17025:2017
- Discuss the resource requirements given in Clause 6 of ISO/IEC 17025:2017
- Recognise the ISO/IEC 17025:2017's requirements listed between sub-clause 7.1 and sub-clause 7.8
- Explain the complaint-handling requirements given in ISO/IEC 17025:2017
- Identify the framework schedule for non-conforming work
- Define the ISO/IEC 17025:2017's requirements for information and data control Discuss the process requirements in Clause 7 of ISO/IEC 17025:2017
- Evaluate the actions for correction

Content

- A. The fundamentals of laboratory systems

Aims and objectives of iso/iec 17025:2017

Accrediting to iso/iec 17025:2017

Main sections of iso/iec 17025:2017

B. B. Essential requirements of laboratory process management

General and structural guidelines for laboratories

Resource requirements for testing laboratories

Contracts, validation, sampling and handling

Technical records, uncertainty, results validity and reports

C. C. Lab management system, complaints and nonconformities

Information management, complaints and nonconformities

Management system requirements

Taking corrective actions

Workshop/Practical work

- Practical session 1: review and annotate a laboratory's quality manual and process documentation.
- Practical session 2: create documentation for a mock testing scenario, including technical record forms and uncertainty estimates.
- Practical session 3: use audit checklists to assess compliance in a simulated lab environment; prepare a summary audit report.
- Practical session 4: analyze case studies of nonconformities and customer complaints; complete root cause analysis and propose corrective actions.
- Practical session 5: assemble a mock accreditation application including scope of accreditation, quality policy, and risk-based management elements.

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%
Quizz	0%

Media employed

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

Reading list

- ISO/IEC 17025:2017. General requirements for the competence of testing and calibration laboratories
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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

1. Definition and objectives of a project
2. Type of projects
3. Typology of companies
4. Actors involved in a project
5. The economic and financial environment of the company
6. The Business model canvas (BMC): Application and workshop

Chapter II: Stages of business creation

1. The profile of the creator and entrepreneurial culture
2. Identification of a project: idea and opportunities
3. Market research
4. Feasibility study
5. Profitability study: Economic and financial evaluation
6. Financing Plan
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

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

Content

- Introduction**
- I. Ethics Guide
 - II. Thinking about Ethical decisions
 - III. Rules vs Principals
 - IV. Fundamental Principals
 - V. The framework
 - VI. Innovation Ethics
 - VII. Innovation Ethics for value based Innovation
 - VIII. Technological evolution, innovations and ethical concerns and dilemmas
 - IX. A framework for understanding (un) ethical decision-making process
 - X. Innovation process models and decision making
 - XI. Moral imagination, systems thinking and multiple perspective approach

Study and examination requirements and forms of examination

Mixed evaluation
The final score is weighted as follows:

Written mid-term exam	50%
Written mid-term exam	50%
Practical works	0%
Written final exam	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 Technology of Animal Products

Module Name	Science and Technology of Animal Products			
Module level	3 rd year			
Code	ECUEF511			
Semester(s) in which the module is taught	Semester 5 (S5)			
Person responsible for the module	Ola ABDELHADI			
Lecturer	Kamel HASNI			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	Food Quality Control (FQC)	x		S5
	Food industry & processing (FIP)			
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	35.5 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	- Conservation Techniques UEF412 (or equivalent) - Food Science UEF333 (or equivalent) - Process engineering UEF322 (or equivalent)			

Module Objectives

- Understand the fundamentals of meat science.
- Assess the different quality criteria for meat.
- Learn the different types of meat products and their technological and quality aspects.
- Understand the process of egg aging and methods for preserving eggs.
- Learn the techno-functional properties of eggs.
- Understand the technologies involved in the production of egg products.
- Study the chemical composition of fishing products and how it affects their quality and processing.
- Learn about the evolution of fishing products and the methods used for their preservation.

Learning outcomes

The student will develop the ability to

- Understand the general principles of meat science, including structure of muscle and its transformation into meat.
- Implement and interpret quality control measures for meat.
- Understand the processes of egg aging and methods for preserving eggs to maintain quality.
- Classify egg products and understand their uses in the food industry.
- Analyze the chemical composition of fishing products and its impact on quality and processing.
- Understand the evolution of fishing products and the methods used for their preservation.

Content

Chapter I: Science and technologies of meat

Part I. Science of meat

- I. Generalities
- II. Muscle
 1. Definition
 2. Structure of the muscle
- III. Transformation of muscle into meat
 1. States of meat

2. Evolution of meat characteristics
 - 2.1 Tenderness
 - 2.2 pH and acidity
 - 2.3 color and taste
 3. Biochemistry of muscle transformation into meat
 - IV. Quality criteria of meat
 1. Nutritional quality
 2. Hygienic quality
 3. Organoleptic quality
 4. Technological quality
 - V. Quality control of meat
 - Part II. Meat preservation and processing technologies
 - I. Chemical methods
 - II. Physical methods
 1. Drying
 2. Smoking
 3. Cold preservation
 4. Heat preservation
 5. Packaging
 - III. Biological methods
 - Part III. Meat Products
- Chapter II: Eggs and egg products**
- Part I. Eggs science
 - I. Definition
 - II. Egg structure
 - III. Nutritional composition of an egg
 1. Composition of albumen
 2. Composition of yolk
 3. Composition of eggshell
 - IV. Classification
 - V. Egg aging
 - VI. Conservation
 - VII. Techno-functional properties of eggs and industrial applications
 - Part II. Technologies of egg products
 - I. Definition
 - II. Classification
 - III. Uses of egg products in food industry
 - IV. Advantageous and disadvantageous of egg products uses
 - V. Manufacturing technologies
- Chapter III: Science and technologies of fishing products**
1. Definition and classification of fishing products
 2. Chemical composition
 3. Evolution of fishing products
 4. Conservation methods

Practicals

- PW1: Visit to meat products industry
- PW2: Visit to fishing products industry

Study and examination requirements and forms of examination

Mixed evaluation
The final score is weighted as follows:

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

- NICOLE, J.P., KNOCKAERT, C., 1989. Les conserves des produits de la mer 159 p. : ill., graph.
- Nau F., Guérin-Dubiard C., Baron F., Thapon J.L., 2010. Science et technologie de l'œuf et

des ovoproduits, Editions Tec et Doc Lavoisier, Paris, France, vol 1, 361p., vol 2, 552p.

- Lawrie RA. Technologie de la Viande et des Produits Carnes By J. P. Girard. INRA Publications, Versailles, 1988. 280 pp. Price: 275·00 F fr. Meat Sci. 1989;25(4):317-8.
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44. Science and Technology of Plant Products

Module Name	Science and Technology of Plant Products				
Module level	3 rd year				
Code	ECUEF512				
Semester(s) in which the module is taught	Semester 5 (S5)				
Person responsible for the module	Ola ABDELHADI				
Lecturer	Dorra SFAYHI				
	Dorra SFAYHI				
Language	French				
Relation to curriculum	Programme		Compulsory	Elective	Semester
	Food Quality Control (FQC)		x		S5
	Food industry & processing (FIP)				
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	35.5 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	- Conservation Techniques UEF412 (or equivalent) - Food Science UEF333 (or equivalent) - Process engineering UEF322 (or equivalent)				

Module Objectives

- Understand the composition and processing of wheat.
- Learn composition and quality control of wheat flour.
- Learn physico-chemical properties and technological processes involved in edible fat.
- Evaluate the consistency of fats and understand the use of fat substitutes and reduced energy intake.
- Acquire knowledge about the various manufacturing operations involved in fruit juice production.

Learning outcomes

The student will develop the ability to

- Perform quality control analysis of wheat flour, including tests and dough behavior analysis
- Understand the physico-chemical properties of fats and oils.
- Evaluate the consistency of fats and understand the use and regulation of fat substitutes
- Understand the complete manufacturing process of fruit juices.
- Develop practical competencies through laboratory analysis and industrial exposure

Content

Chapter I: Cereal Technology

1. Wheat presentation and composition
2. Milling
3. Wheat flour: composition and quality control analysis
4. Study of dough behavior

Chapter II: Technology of Edible fats

1. Lipids
 - 1.1 Definition
 - 1.2 Sources of fats
 - 1.3 Roles of fats in the diet
2. Physico-chemical properties of fats
3. Technological processing of fats
 - 3.1 Preparation of fats and oils
 - 3.2 Extraction of vegetable oils

- 3.3 Treatment and purification
- 3.4 Modification treatments
 - 3.4.1 Fractionation
 - 3.4.2 Transesterification
 - 3.4.3 Partial and total hydrogenation
- 4. Methods for evaluating the consistency of fats
- 5. Fat substitutes and reduced energy intake
- 6. Regulations on edible fats

Chapter III: Fruit-Based beverage technology

- 1. Fruit juice: designations and composition
- 2. Manufacturing operations
 - 2.1 Picking
 - 2.2 Fruit preparation
 - 2.3 Extraction
 - 2.4 Decantation and storage
 - 2.5 Sieving and centrifugation
 - 2.6 Clarification
 - 2.7 Pasteurization
 - 2.8 Packaging

Practicals

- PW1: Analysis and biochemical characterization
- PW2: Visit to wheat milling industry
- PW3: Visit to oil milling factory
- PW4: Visit to vegetables/fruits storage facilities

Study and examination requirements and forms of examination	Mixed evaluation	
	The final score is weighted as follows:	
	Written mid-term exam	20%
	Practical works	10%
	Written final exam	70%
	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	▪ Albagnac, P. G., Varoquaux, J., & Montigaud, C. I. (2002). Technologies de transformation des fruits. Ed. Tec & Doc, cop.- XXII, Paris/Londres/New York, p. 498. ▪ Pages X, Morin O. Industries des corps gras. In : De Reynal B, Multon JL (Eds), Additifs et auxiliaires de fabrication dans les industries agroalimentaires. Paris, Lavoisier, 2009. ▪ Pages X, Morin O, Birot C et al. Raffinage des huiles et des corps gras et elimination des contaminants. Oleagineux Corps gras Lipides 2010 ; 17 : 86-99. ▪ Bourson, Y., "Mouture de blé tendre et techniques d'obtention de la farine ", F 6175, technique de l'ingénieur, (2009) ,1-23. https://doi.org/10.51257/a-v1-f6175	

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45. Food traceability

Module Name	Food traceability			
Module level	3 rd year			
Code	ECUEF521			
Semester(s) in which the module is taught	Semester 5 (S5)			
Person responsible for the module	Ines ELLOUZE			
Lecturer	Kamel HASNI			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	Food Quality Control (FQC)	x		S5
	Food industry & processing (FIP)		x	S4
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	14hrs	20-40 students	
	Workshop			
	PW	7hrs	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	No previous prerequisites			

Module Objectives

- Introduce the principles and importance of traceability in the animal production sector.
- Explain the genetic and molecular bases used for identifying and tracking animals and animal-derived products.
- Present key traceability techniques and their application to food quality and safety.
- Develop practical skills in implementing traceability systems in real-world scenarios

Learning outcomes

The student will develop the ability to

- Define the concept of traceability and its relevance to animal and food product safety.
- Explain genetic variability and describe how molecular markers are used for animal identification.
- Identify and compare various traceability techniques used in the animal industry.
- Apply appropriate traceability methods to monitor animal products throughout the supply chain.
- Evaluate the role of traceability systems in improving food product quality and consumer confidence.
- Implement a basic traceability system through practical work and case study analysis.

Content

Chapter I: Introduction
Chapter II: Traceability of animals and animal products
Chapter III: Concepts of genetic variability
Chapter IV: Molecular markers
Chapter V: Traceability techniques
Chapter VI: Traceability techniques for animal products
Chapter VII: Application of traceability for food products quality

Practicals

- PW1: Identification of traceability techniques
- PW2: Implementation of traceability system

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	Digital presentations, Visit manual and Personal work series are available on ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	
Reading list		

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46. Sensory analysis and Rheology

Module Name	Sensory analysis and Rheology			
Module level	3 rd year			
Code	UEF522			
Semester(s) in which the module is taught	Semester 5 (S5)			
Person responsible for the module	Ines ELLOUZE			
Lecturer	Ines ELLOUZE			
Language	French			
Relation to curriculum	Programme	<i>Compulsory</i>	<i>Elective</i>	<i>Semester</i>
	Food Quality Control (FQC)	x		S5
	Food industry & processing (FIP)			
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	14hrs	20-40 students	
	Workshop			
	PW	7hrs	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 ECUEF111 :Applied mathematics (or equivalent) - Module ECUEF112 :Physics (or equivalent)			

Module Objectives

- Provide the 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
- Provide the students with an in-depth understanding of the basics of rheology and rheological behaviours

Learning outcomes

- The student will develop the ability to
- Understand human sensory perception;
- Master practical realisation of different sensory tests;
- Implement sensory experiment using appropriate statistical tools
- Apply targeted sensory evaluation method to address specific challenges in food analysis
- Understand and differentiate rheological behaviours.

Content

- **Part 1 : Sensory evaluation**
 - Introduction
 - CHAPITRE I : Sensory physiology**
 - Physiology of the different sens
 - Levels of sensory perception
 - CHAPITRE II : Characteristics of sensory responses and metrology**
 - Hedonic quality and quantity
 - Subjective-Objective
 - Characteristics of sensory evaluation
 - CHAPITRE III : Practical organisation and data analysis**
 - Construction of a panel
 - Establishment of experimental design
 - Sensory evaluation
 - Different types of sensory tests
 - Difference testing

- **Comparative testing**
- **Sensory profiles**
- **Statistics analysis and results interpretation**

● **Part 2 : Rheology**

- **Stress and deformation**
- **Fluids rheological behaviours**
- **Different types of rheometers**
- **Texture Profile Analysis**

Practical Work

- **PW1: Preparing for a sensory evaluation: highlight the sens**
- **PW2: Sensory evaluation of a drink (juice, water, soft drink)**

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 and Practical manual are available on ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	▪ ANALYSE SENSORIELLE, Afnor, ISBN 978-2-12-190873-1 ▪ INITIATION A LA RHEOLOGIE BASES THEORIQUES ET APPLICATIONS EXPERIMENTALES, Guy Couarraze, ISBN 978-2743015688								

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47. Hygiene in Food Industry

Module Name	Hygiene in Food Industry				
Module level	3 rd year				
Code	ECUEF523				
Semester(s) in which the module is taught	Semester 5 (S5)				
Person responsible for the module	Ines ELLOUZE				
Lecturer	Chalbia MANSOUR				
	Chalbia MANSOUR				
Language	French				
Relation to curriculum	Programme	Compulsory	Elective	Semester	
	Food Quality Control (FQC)	x		S5	
	Food industry & processing (FIP)				
Type of teaching, contact hours	Type of teaching	Contact hours	Class size		
	Lecture	14hrs	20-40 students		
	Workshop	7hrs	20-40 students		
	PW				
Workload	Total	21 hrs	Self-study	30 hrs	
Credit points	2	Coefficient	1		
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams				
Recommended prerequisites	- Module ECUEF431: Quality control management - Module UEF333: Food science - Module UEF332: Toxicology				

Module Objectives

- Understand the principles of food safety
- Understand the importance of hygiene in the food industry
- Understand the different types of food contamination (physical, chemical and microbiological)
- Learn the basic measures to protect consumer's health
- Understand the HACCP approach

Learning outcomes

- The student will develop the ability to
- Recognize and identify food contamination
 - Apply Good Hygiene Practices
 - Establish a cleaning and disinfecting plan
 - Identify critical control points (CCP)
 - Establish a HACCP plan

Content

Chapter I: Introduction

1. Definition of food hygiene
2. Definition of food security and safety
3. Benefits of health control

Chapter II: Food hazards: nature, source and control

1. Physical hazards
2. Chemical hazards
3. Microbiological hazards

Chapter III: Good Hygiene Practices

1. Workforce
2. Machine
3. Medium
4. Material
5. Method

Chapter IV: The HACCP approach

1. Definition
2. History
3. Objectives
4. Principles
5. The different stages
6. The advantages
7. The relationship between ISO 22000 and HACCP

Practical work

- PW1: Hygiene and food risks
 PW2: Good Hygiene Practices
 PW3: HACCP
 PW4: evaluation of a pest control program

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>30%</td></tr> <tr> <td>Practical works</td><td>0%</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	30%	Practical works	0%	Written final exam	70%	Quiz/QCM at the end of each main chapter	0%
Written mid-term exam	30%								
Practical works	0%								
Written final exam	70%								
Quiz/QCM at the end of each main chapter	0%								
Media employed	Digital presentations, and Personal work series are available on ISBB Extranet (https://isbb.rnu.tn/) for course material sharing								
Reading list	▪ FAO. 2023. Introduction to Hazard Analysis and Critical Control Point (HACCP). FAO Good Hygiene Practices (GHP) and Hazard Analysis and Critical Control Point (HACCP) Toolbox for Food Safety. Rome. https://doi.org/10.4060/cc6246en ▪ Microbiologie et toxicologie des aliments : Hygiène et sécurité alimentaires. Guy Leyral & Elisabeth Vierling 4^e Edition. ISBN: 2-7040-0856-6.								

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48. Preservation, conditioning and packaging techniques

Module Name	Preservation, conditioning and packaging techniques			
Module level	3 rd year			
Code	UEF531			
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 Quality Control (FQC)	x		S5
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshops	07 hrs	20-40 students	
	PW	07 hrs	10-20 students	
Workload	Total	58 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 UEF322 : Process Engineering (or equivalent) - Module UEF412 : Conservation Techniques (or equivalent)			

Module Objectives	- Understand the concept of food quality and shelf life; - Learn food preservation techniques; - Know the concept of conditioning and packaging; - Know the different packaging materials and their roles in the conservation, transport, handling, storage, distribution, etc. of food products.
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Learning outcomes	The student will be able to: - Differentiate between “Shelf life expiration date” (SLED) and “Best before date (BBD)”; - Explain the role of microbiological and physicochemical reactions and the limitations of food preservation; - Differentiate between conditioning and packaging; - Differentiate between the different types of packaging (properties, roles) and the functions they offer for stabilizing the food and extending its shelf life during the different stages of transport and storage; - Apply critical thinking and food science principles to solve problems related to food preservation and to ensure food quality control.
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Content	CHAPTER I: Food preservation Introduction
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1. Deterioration reactions in food quality
2. Cold techniques
3. Heat treatments
4. Non-thermal destruction of microorganisms
5. Whitening
6. Conservation by acidification of the environment
7. Conservation by reduction of aw (depressant agents)
8. Dehydration of food

CHAPTER II: Conditioning and packaging techniques

Definitions

1. Packaging and packaging materials:

Structure and properties, cost, compatibility, storage conditions, quality control

2. Active and intelligent packaging

3. Packaging: Palletization, handling, storage and full packaging

4. Packaging of finished food products, presentation, influence on quality, expiry dates, labeling, biodegradable systems

5. Packaging of organic products for industrial use, bulk, retail, storage conditions

Practical work

- **PW1:** Visit to the Technical center of packaging and conditioning, Tunisia (Centre technique de l'emballage et du conditionnement PACKTEC).
- **PW2 :** Study of some functional characteristics of edible food packaging.

Workshops

- **WS1 :** Study the advantages and the limitations of food preservation techniques
- **WS2 :** Study the role and properties of some conventional packaging materials
- **WS 3 :** Compare the characteristics of active and smart edible food packaging to conventional packaging

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%
Questions at the end of each main chapter	0%

Media employed

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

Reading list

- SCIENCE ET TECHNOLOGIE DES ALIMENTS : Principes de chimie des constituants et de technologie des procédés. Presses polytechniques et universitaires romandes : Lausanne 2010, ISBN: 9782880747541
- 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

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49. Standardisation, normalisation, certification

Module Name	Standardisation, normalisation, certification			
Module level	3 rd year			
Code	UEF531			
Semester(s) in which the module is taught	Semester 5 (S5)			
Person responsible for the module	Mourad Jridi			
Lecturer	Mourad Jridi			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)	x		S5
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshops	0 hrs	20-40 students	
	PW	07 hrs	10-20 students	
Workload	Total	58 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	- Module UEF322 : Process Engineering (or equivalent) - Module UEF412 : Conservation Techniques (or equivalent)			

Module Objectives	- Understand the principles of quality, standardization, and certification in agri-food and industrial contexts. - Master a wide range of quality management tools for continuous improvement. - Apply international standards such as ISO 9001, ISO 22000, ISO 17025 in real-world scenarios. - Analyze the processes of certification, accreditation, and product labeling from both technical and strategic perspectives. - Develop audit plans and apply quality tools within selected standard frameworks. - Evaluate the impact of quality and sustainability standards on food safety, traceability, and consumer trust.
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Learning outcomes	The student will be able to: - Explain the rationale and principles behind quality improvement tools and international standards. - Identify, compare, and apply basic and advanced quality management tools (e.g., 5S, Pareto, FMEA, Gantt). - Describe the structure and requirements of key certification systems (ISO 9001, ISO 22000, HACCP, ISO 17025). - Evaluate the steps, stakeholders, and implications of certification and accreditation processes. - Apply quality management tools within selected ISO frameworks through practical case studies. - Prepare and present an audit plan for ISO 9001 certification in the agri-food sector. - Conduct bibliographic research and report on the certification processes of food products. - Discuss the socio-economic and environmental implications of food certifications and labeling systems.
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- Demonstrate knowledge of sustainability-related standards and their application in food quality management.
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Content

Part 1: Introduction

- Rationale behind implementing quality improvement tools based on international standards
- Types of tools and how to use them
- Data analysis techniques
- Identifying solutions and recording improvements
- Steps to implement a quality improvement process
- Practical applications and interactive learning approach

Part 2: Quality Management Tools

A. Tools for Implementation

- Kaizen – The 5S Method
- Teamwork
- Brainstorming
- “Is & Is Not” logic
- Data collection sheet
- Frequency histogram
- 5W2H (Who, What, Where, When, Why, How, How much)
- Flowchart

B. Tools for Execution

- Pareto chart
- Cause-and-effect diagram (family-based method)
- Cause-and-effect diagram (process-based method)
- Multi-criteria diagram
- Weighting matrix
- Typology diagram
- Decision tree

C. Tools for Improvement

- Scatter diagram
- Progress diagram
- Event diagram
- Gantt chart
- Radar chart
- Project report
- Graphs

D. Other Tools

- FMEA (Failure Modes and Effects Analysis)
- Value analysis
- Six Sigma

Part 3: Application Cases

A. Online Application Cases

- International recognition
- Certification process: procedures and selection of certification bodies
- Accreditation process: procedures and selection of programs

B. Selection of One or More Reference Frameworks

- ISO 9001 – ISO 22000/HACCP – ISO 17025

C. Application of Tools Within the Chosen Framework(s)

Part 4: Summary and Evaluation of the Course

- Quality concepts in the agri-food sector
- Accreditation systems
- Certification of management systems:
 - ISO 9001 (Quality Management System)
 - ISO 14001 (Environmental Management System)
 - OHSAS 18001 (Occupational Health & Safety Management System)
 - HACCP and ISO 22000 (Food Safety Management Systems)
- Product certifications (“official signs of quality and origin” and “environmental labeling”) and their economic context
- Guest testimonials on the implementation of these systems in public administrations and French companies
- Introduction to sustainability standards and frameworks

Tutorials and Practical Work

- Preparing an ISO 9001 audit plan based on the quality manual of an agri-food company
- Literature review and report presentation on food product certification

Study and examination requirements and forms of examination	Mixed evaluation The final score is weighted as follows:	
	Presentation	10%
	Mid-term exam	20%
	Written final exam	70%
	Questions at the end of each main chapter	0%
Media employed	Digital presentations and Lab work manual are on the ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	
Reading list	▪ ISO 9001:2015 – <i>Quality Management Systems – Requirements</i> ▪ ISO 22000:2018 – <i>Food Safety Management Systems – Requirements for any organization in the food chain</i> ▪ ISO 17025:2017 – <i>General requirements for the competence of testing and calibration laboratories</i> ▪ Codex Alimentarius (FAO/WHO) – <i>General Principles of Food Hygiene, CXC 1-1969</i> ▪ HACCP Guidelines – <i>Hazard Analysis and Critical Control Point System and Guidelines for its Application (Codex)</i> ▪ OHSAS 18001 / ISO 45001:2018 – <i>Occupational Health and Safety Management Systems</i> ▪ ISO 14001:2015 – <i>Environmental Management Systems – Requirements with guidance for use</i>	

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50. Biochemical Control of Foods

Module Name	Biochemical Control of Foods			
Module level	3 rd year			
Code	UEO511			
Semester(s) in which the module is taught	Semester 5 (S5)			
Person responsible for the module	Ola ABDELHEDI / Chedia AOUADHI			
Lecturer	Ola ABDELHEDI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)		x	S5
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshops	07 hrs	20-40 students	
	PW	10.5 hrs	10-20 students	
Workload	Total	38.5 hrs	Self-study	12 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 : Structural biochemistry (or equivalent) - Module UEF311 : Food biochemistry (or equivalent)			

Module Objectives	- Understand the differences between water content, humidity and water activity; - Classify food additives according to their roles; - Learn the legal approach in food formulation; - Learn the properties of proteins, lipids and polysaccharides and their roles in foods; - Understand the structure-function relationships of proteins, lipids and polysaccharides and their roles in foods.
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Learning outcomes	The student will be able to: - Explain the importance of water activity in food deterioration. - Explain the role of food additives in foods and their legal application. - Understand the techno-functional properties of food macromolecules and their role on the physico-chemical properties in food : Establish structure-function relationships. - Understand the standards and regulations related to food to ensure food safety and quality. - Master the role of the analytical techniques to control food quality and solve practical problems.
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Content	CHAPTER I: Water and its importance in food quality - Properties and availability of water in foods - Water activity and food modifications: chemical and enzymatic alterations, development of microorganisms CHAPTER II: Control of food additives - Codification of food additives and standards - Presentation and role of some natural and chemical additives: anti-oxidants, food colorings, gelling agents, preservatives, flavor enhancers, etc. CHAPTER III: Dietary carbohydrates - Source and importance in the diet - Gelation properties - Techno-functional role in foods CHAPTER IV: Dietary proteins
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1. Biological sources and nutritional quality control
Animal proteins (milk, eggs, meat)
Plant proteins (albumins, prolamins, glutelins and globulins)
2. Techno-functional properties: Elasticity, gelling, emulsification, etc.

CHAPTER V: Dietary lipids

1. Properties of lipids
2. Quality of oils: sources, study methods
3. Role of emulsifying agents in foods

Practical work

- **PW1:** Industrial visit to the “Centrale Laitière du Cap Bon (CLC)”: Determination of milk acidity; Determination of milk fat using the Gerbert method; Determination of milk proteins level ...
- **PW2 :** Study the gelling proteins of some dirty carbohydrates
- **PW3:** Preparation of an emulsion using different emulsifying agent (gum, egg yolk) - Study of the emulsifying property of egg yolk

Workshops

- **WS1:** Case study : Identify and determine the role of the food additive appropriate to the food type
- **WS2 :** Presentations on the role of dietary macromolecules in some foods (case studies).

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	30%
	Workshops	10%
	Practical works	20%
	Quiz at the end of each main chapter	0%
Media employed	Digital presentations and Lab work manual are on the 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 ● SCIENCE DES ALIMENTS, Volume 2 : Technologie des produits alimentaires (Biochimie • Microbiologie • Procédés • Produits). Lavoisier 2007, ISBN 2-7430-0888-8	

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50. Quality control of animal-based foods

Module Name	Quality control of animal-based foods			
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 Quality Control (FQC)		x	S5
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	7 hrs		
	PW	10.5 hrs	10-20 students	
Workload	Total	38.5 hrs	Self-study	12 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	- Develop knowledge of quality control principles specific to animal-based foods - Understand regulatory requirements and industry standards for meat, dairy, seafood, eggs and fats - Practical Skills Development - Master essential testing methods for physicochemical, microbiological and sensory evaluation - Gain proficiency in detecting adulteration, contamination and quality defects - Quality Assurance Application - Apply quality control measures throughout production and processing - Implement food safety systems to meet compliance standards - Analyze test results to make informed quality decisions
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Learning outcomes	The student will be able to: - Identify different categories of animal-based foods and their key quality attributes. - Recognize factors affecting the quality and shelf life of animal-derived products. - Analyze physical (texture, color, moisture) and chemical (protein, fat, ash) quality parameters. - Detect common contaminants and apply preventive measures.
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Content	Chapter I: Generalities - General Concepts of Food Quality Control - Importance of quality control in animal-based foods - Regulatory standards (CODEX, FDA, EU, ISO) - Key quality parameters and safety hazards 1. Quality Control of Milk and Dairy Products - Physical & Chemical Analysis - Fat content, protein, lactose, acidity, pH, density - Adulteration detection (water, starch, synthetic milk) - Microbiological Testing - Total plate count, coliforms, pathogens (<i>Salmonella</i>, <i>Listeria</i>) - Shelf-Life & Sensory Evaluation - Off-flavors, texture defects, spoilage indicators 2. Quality Control in Meat and Meat Products - Fresh Meat Quality Assessment - pH, color (myoglobin), water-holding capacity - Detection of PSE (Pale, Soft, Exudative) and DFD (Dark, Firm, Dry) meat
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- Processed Meat Analysis
 - Nitrite levels, salt content, protein/fat ratio
 - Detection of undeclared additives (phosphates, soy extenders)
 - Microbial & Parasitic Hazards
 - *E. coli*, *Salmonella*, *Trichinella* (microscopy/PCR)
3. Quality Control of Fishery Products
- Freshness Indicators
 - TVB-N (Total Volatile Basic Nitrogen), histamine, ATP degradation
 - Sensory evaluation (odor, gill color, texture)
 - Processing & Preservation Quality
 - Salt content in cured fish, moisture in dried products
 - Detection of formaldehyde (illegal preservative)
 - Parasites & Toxins
 - Anisakiasis detection, heavy metals (Hg, Cd)
4. Quality Control in Eggs and Egg Products
- Fresh Egg Evaluation
 - Candling, Haugh units (albumen quality), yolk index
 - Detection of cracks and blood spots
 - Processed Egg Products
 - Microbial safety (*Salmonella* in liquid eggs)
 - Pasteurization efficiency testing
 - Adulteration & Shelf-Life
 - Detection of artificial coloring in yolks
5. Fatty Food Group (Animal Fats & Oils)
- Quality Parameters
 - Peroxide value, free fatty acids (FFA), iodine value
 - Detection of rancidity (TBARS test)
- Practical Work:
- Peroxide value titration
 - TBARS spectrophotometry
 - Fatty acid profiling (TLC demonstration)
 - TVB-N titration
 - Histamine rapid test strips
 - Sensory profiling exercises

Study and examination requirements and forms of examination	Mixed evaluation 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 and Lab work manual are on the ISBB Extranet (https://isbb.rnu.tn/) for course material sharing	
Reading list		

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51. Food microbiological control				
Module Name	Food microbiological control			
Module level	3 nd year			
Code	UEO512			
Semester(s) in which the module is taught	Semester 5 (S5)			
Person responsible for the module	Chedia AOUADHI/Ola ABDELHEDI			
Lecturer	Chedia AOUADHI			
Language	French			
Relation to curriculum	Programme	Compulsory	Elective	Semester
	Food Quality Control (FQC)		x	S5
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	38.5 hrs	Self-study	12 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 UEF222: Microbiology - Module UEF321 : Food Microbiology			

Module Objectives	- Give students an overview of the activities of a microbiological control laboratory in industry - Acquire knowledge of microbiological analysis methods (quantitative and qualitative) - Acquire adequate and advanced knowledge in the field of microbiological control using molecular and immunological techniques - Master the various controls carried out at the industry level (primary material control, control during manufacturing, finished product controls, etc.)
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Learning outcomes	The student will be able to: - Receive samples or take samples of materials and products for quality control - Prepare samples for microbiological analysis - Master microbiological analytical techniques - Master the techniques for identifying microorganisms and the main microbial groups involved in the food industry, either as a health hazard, or spoilage agent, or fermentation agent, or probiotic, or other technological utility - Identify conditions that can cause food to spoil. - Perform a microbiological titration of antibiotics
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Content	CHAPTER I: Prerequisites for bacteriological analysis I. Preparation of material II. Rational use of devices III. Sample collection IV. Transport and storage of samples V. Grinding solid foods VI. Surface sampling CHAPTER II: Bacteriological manipulations and control techniques 1. Decimal dilution 2. Interpretations of the results 3. Spiral seeding method 4. Direct microbial enumeration 5. Indirect microbial application 6. Micro-organisms at 30°C or so-called ordinary aerobic flora 7. Psychrotrophic bacteria 8. Heat-resistant bacteria
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9. Caseolytic germs
 10. Lipolytic flora
 11. *Stahylococcus aureus*
 12. Fecal streptococci
 13. *Clostridium sulfitoreducers and perfringens*
 14. Clostridium of the butyric group
 15. Coliforms and *E. coli*
 16. Indologenic sprouts
 17. Putrid Germs
 18. Yeasts and molds
 19. Salmonella
 20. Lactic flora
 21. Bacteriophage
 22. Mastitis

CHAPTER III: Different controls

1. Control of raw materials and products
2. Water control
3. Milk and dairy products
4. Microbiological controls linked to milk processing
5. Microbiological controls of dairy products at distribution
6. Microbiological controls of beer and soft drinks
7. Microbiological controls of meat and meat products
8. Microbiological controls of eggs and ovo products
9. Microbiological controls of fish products
10. Microbiological controls of fruits and vegetables
11. Microbiological controls of dehydrated products
12. Microbiological controls of canned and semi-preserved foods
13. Microbiological checks of cooked meals

CHAPTER IV: Rapid detection methods in food microbiology

1. Miniaturized biochemical tests
2. Physicochemical tests
3. Immunological methods
4. Genetic method
5. Limitations of rapid food microbiology methods

CHAPTER V: Analysis in antibacterial microbiology

- I. Microbiological titrations of antibiotics
 - I.1. Principle of methods
 - I.1.1. Diffusion assays
 - I.1.2. Turbidimetric assays
 - I.2. Test microorganisms
 - I.3. Culture media
 - I.4. Preparation of solutions to be dosed
 - I.5. Incubation
 - I.6. Reading
 - I.7. Statistical analysis
 - I.8. Choice of method to use
 - I.9. Automating
- II. Microbiological methods for detecting traces of antibiotics in food
 - II.1. Official method for detecting antibiotics in meat and aquaculture products
 - II.2. Official method for detecting antibiotics in milk
- III. Determination of antimicrobial activity of antiseptics and disinfectants
 - III.1. Definitions
 - III.2. Standard NF EN 1276
 - III.3. Application domain
 - III.4. Methodology

Practical work

- PW 1: Rapid microbiological analysis methods
 - PW 2: Microbiological titration of antibiotics
 - PW 3: Application of microbiological methods for the detection of traces of antibiotics in food
 - PW 4: Microbiological techniques for determining the antimicrobial activity of antiseptics and disinfectants
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Workshops

WS 1: Microbiological control of UHT milk
WS2: Microbiological control of chocolate
WS3: Microbiological control of yeast
WS4: Microbiological control of butter
WS5: Microbiological control of water

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	30%
Practical works	20%
Workshops	10%
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

- C. BONNEFOY., F. GUILLET., G. LEYRAL., E. VERNE-BOURDAIS., microbiologie et qualité dans les industries agroalimentaires. Série Sciences des aliments. Collection Biosciences et Techniques, (2002).
- C. M. BOURGEOIS., J. F. MESCLE., J. ZUCCA., microbiologie alimentaire, tom 1 : aspect microbiologique de la sécurité et de la qualité des aliments. TEC & DOC.11, Lavoisier, (1996).
- C. M. BOURGEOIS., J. Y. LEVEAU., techniques d'analyse et de contrôle dans les industries Agro-alimentaires : le contrôle microbiologique. Ed. Technique et Documentation, (1980).
- C. VERNOSY-ROZAND., méthodes de détection rapide en microbiologie alimentaire. Collection série technique de l'ingénieur.
- D. ROBERTS., M. GREENWOOD., practical food microbiology, third edition, (2003).
- E. LEBRES., F. MOUFFOK., guide pratique d'analyses microbiologiques des denrées alimentaires : Service de bactériologie alimentaire., institut Pasteur d'Algérie., janvier 1999, p24.
- E.L. CARRY JANET., G.D.W. CURTIS., R.M. BAIRD., handbook of culture media for food Microbiology volume 37. Elsevier Science, (2003).
- F. BALEDENT., les cellules hématimètres Biologiste, hôpital de Saint-Denis, France. H. PRESCOTT., laboratory Exercises in Microbiology, fifth Edition, 2002., 449 pp.
- J. GUIRAUD., P. GALZY., l'analyse Microbiologique dans les industries alimentaires, l'usine, (1980).
- J. Y. LEVEAU., J. P. LARPENT., M. BOUIX., sécurité microbiologique des procédés alimentaires. Collection série technique de l'ingénieur.
- Norme ISO 6888-1., Microbiologie des aliments. Méthode horizontale pour le dénombrement des staphylocoques a coagulase positive (staphylococcus aureus et autres espèces). Partie 1 : technique utilisant la gélose Baird- Parker, référence de la technique. Norme Ministère de commerce., arrêté du 23 juillet 1994 relatif aux spécifications microbiologiques de certaines denrées alimentaires.
- Norme NA 1207., microbiologie des aliments. Méthode horizontale pour le dénombrement des micro-organismes, technique par comptage des colonies à 30°C, référence de la technique.
- Norme NA 15177., microbiologie des aliments – méthodes horizontales pour les techniques de prélèvement sur des surfaces, au moyen de boîtes de contact et d'écouvillons. 2006.
- Norme NA 6803 / ISO 4832., microbiologie des aliments. Méthodes horizontales pour le dénombrement des coliformes, technique par comptage des colonies, référence de la technique.
- Norme NA ISO 7218., microbiologie des aliments exigences générales et recommandations.
- Norme NA 15176., Microbiologie des aliments, méthode horizontale pour le dénombrement des bactéries sulfite-réductrices se développant en conditions anaérobies, référence de la technique.

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51. Quality control of plant-based foods

Module Name	Quality control of plant-based foods			
Module level	3 rd year			
Code	UE0511			
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	Semester
	Food Quality Control (FQC)		x	S5
Type of teaching, contact hours	Type of teaching	Contact hours	Class size	
	Lecture	21 hrs	20-40 students	
	Workshop	7 hrs		
	PW	10.5 hrs	10-20 students	
Workload	Total	38.5 hrs	Self-study	12 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 differences between water content, humidity and water activity; - Classify food additives according to their roles; - Learn the legal approach in plant-based foods; - Learn the properties of proteins, lipids and polysaccharides and their roles in plant-based foods;
Learning outcomes	The student will be able to: - Identify different categories of plant-based foods and their key quality attributes. - Recognize factors affecting the quality and shelf life of plant-derived products. - Analyze physical (texture, color, moisture) and chemical (protein, gluten, ash) quality parameters. - Detect common contaminants (mycotoxins, heavy metals) and apply preventive measures.

Content	Generalities - Introduction to Food Quality Control - Importance of quality control in plant-based foods - Regulatory standards and food safety guidelines Plant Food Groups - Classification of plant-based foods - Key quality parameters for different plant food categories Quality Control in Cereals and Derivatives - Physical and chemical quality parameters - Moisture content, protein, gluten, and ash analysis - Detection of mycotoxins and contaminants Quality Control of Fruits and Vegetable Derivatives - Maturity indices and post-harvest quality assessment - Testing for pesticides and residues - Microbiological safety in processed fruits and vegetables Quality Control in Juices and Soft Drinks - Brix, acidity, and pH measurement - Detection of adulterants and preservatives - Microbiological and sensory evaluation Canned Food Quality Control - Sterilization validation and seal integrity tests
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- pH, vacuum, and headspace analysis
- Detection of spoilage indicators

Practical Work

- Hands-on lab sessions for quality testing methods
- Use of analytical instruments (pH meter, refractometer, moisture analyzer)
- Case studies and problem-solving exercises

Workshops:

WS 1: Case study of **Cereals and Derivatives**

WS 2: Projects on **Control of Fruits and Vegetable Derivatives**

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: <table> <tr> <td>Written mid-term exams</td><td>50%</td></tr> <tr> <td></td><td>50%</td></tr> <tr> <td>Practical works</td><td>0%</td></tr> <tr> <td>Written final exam</td><td>0%</td></tr> <tr> <td>Quiz/QCM at the end of each main chapter</td><td>0%</td></tr> </table>	Written mid-term exams	50%		50%	Practical works	0%	Written final exam	0%	Quiz/QCM at the end of each main chapter	0%
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	Digital presentations are available on ISBB Extranet (https://isbb.rnu.tn/) for course material sharing										
Reading list	▪ Hisrich, R.D., Peters, M.P., & Shepherd, D.A. (2020). <i>Entrepreneurship</i>. 11th Edition. McGraw-Hill Education.										

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54. 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

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.

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

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

	Module Handbook Food Quality Control (FQC)	ENR-CD-06
		06/02/2023

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.

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

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

Study and examination requirements and forms of examination

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

Media employed

Reading list

internship notebook

	Module Handbook	ENR-CD-06
	Food Quality Control (FQC)	06/02/2023

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