FOOD SCIENCE/TECHNOLOGY STUDIES

Fundamental science
Food chemistry and analysis and nutrition
Food safety and microbiology and environment
Food engineering and technology
Food management and business

The aims of these undergraduate studies
To prepare
-professionals for industry (management of production, quality control, research and development, process design). They are called Ingenieur in Europe.
-and/or candidates for research and/or academic carreer.

Duration of studies = 4 years or 5 years, where the first two years are mainly devoted to Fundamental Sciences.
The duration 5 (3 + 2) years are more advanced than the 4 year programme and therefore roughly equivalent to a Master of Science.
After the 4 year programme, the students can be accepted for a Master programme or a Doctorate.

This curriculum is built with 4 years, with 2 semesters per academic year (total 8 semesters).
From these 8 semesters we can imagine 3 for fundamental science courses.
The change to 5 years will include more specialized modules or expanded modules, more projects and research period or industry training periods. Projects may be decided according to specialization, related to food product or to food process or to food management.
In the European Credit Transfer System, one semester of studies represents 30 credits (ECTS).
- 2 credits are roughly equivalent to about 1 hour of classroom contact or 2-3 hours of lab per week, although the exact equivalence depends on the type of instruction chosen.
Optional part of studies may represent 25% of the full time.
- these credits may be used for liberal arts requirements or to provide specific emphases in certain areas of food science.

Comments on the content of studies
The content of studies must be associated with active teaching methods that contribute to the development of personal skills, through scientific teaching.
Studies are formed with lectures, practicals with necessary assessment. Three levels can be envisaged: general/basic, applied to food, industrial level.
Language coures, research and/or industrial training periods are considered as part of studies with an importance to be defined. Languages are included in Fundamental Science. Training periods are included in optional part.

Prepared by : IUFoST Core Curricula Working Group
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Fundamental science

1.Mathematics
Calculus, linear algebra
Differential equations
Probability, statistics
Experimental design and data processing

2.Computer science
Computer structure, algorithms
Elements of programming, e.g. C++

3.Physics
Mechanics, elements of relativity
Electricity and magnetism
Elements of quantum mechanics
Atomic physics

4.Chemistry
General and inorganic chemistry
Organic chemistry
Physical chemistry (chemical thermodynamics, gaseous state, liquid state, solutions,solid state, surface chemistry, reactions kinetics)
Analytical chemistry (+ laboratory)

5.Biology
Cell biology (genetics,…)
Microbiology (+ laboratory)
Biochemistry (+ laboratory)

6.Elements of material sciences
Metals, polymers, gels,composite materials, ceramics.

7. Languages

8. Communication skills

Food chemistry and analysis, and nutrition

1.Food chemistry and biochemistry
Water, proteins, carbohydrates, lipids, carotenoids, other constituents
Biochemical reactions and their control
- enzymic and non enzymic browning ; lipid oxidation ; food colour, flavour and texture reactions ; etc.
Functional additives

2.Food physics
Physical properties of foods
Continuum approach: rheology, gels, sols
Dispersed systems, emulsions, suspensions, powders

3. Food analysis
Sampling methods
Benchtop (wet chemistry) and instrumental methods (chromato, HPLC, potentiometry, refractometry, spectrophotometry, NIR, RMN,…)
Sensory analysis (methods, tests, consumer preference studies, statistics…)
Enzymatic and immunological methods
Chemical indicators of food spoilage and adulteration

4.Nutrition
Human nutritional requirements: calories, proteins, vitamins, minerals, fibers
Nutrients : dietary sources, bioavailabaility and metabolic processes
- deficiencies and excesses
Effect of processing on nutritional value
Food and health
- functional foods, etc.

Food safety and microbiology and environment

1.Food microbiology
Microbiology of food spoilage
Plant hygiene, CIP (Cleaning In Place), Biofilms
Laboratory methods ; Rapid methods

2.Quality assurance, HACCP, GMP (Good Manufacturing Practice)

3.Industrial microbiology
Industrial fermentations (wine, alcohol, lactic)
Production of food ingredients by biotechnology: acids, flavours, pigments…

4. Food toxicology ; food poisoning

5.Environment
Air (odour, dust), water (treatment entrance and wastes), solid wastes, noise

Food Engineering and Technology

1.Food Manufacturing Technology
1.1.Raw materials = Processing quality of raw materials
Composition, size, shape, mechanical properties

Examples: tomatoes, sugar beets, wheat…
1.2.Transformation processes = Description, methods, equipments, flow diagrammes
Size reduction, mixing, washing, cleaning
Separation S/L, L/L, extraction, centrifugation
Extrusion
1.3.Preservation processes = techniques and products
Refrigeration and freezing
Thermal processing, F, Z values = pasteurization, sterilization, HTST; microwaves, ohmic heating, infrared
Moisture control, water activity = drying, salting, osmotic dehydration
Chemical preservatives
Ionizing irradiation
Other technologies: high pressure, pulsed energy, light…
Combined methods
1.4.Food packaging and storage
Packaging = requirements of the package (protection, information, selling); package-food interactions + atmosphere
Storage and shelf life = physical, chemical and microbial end points, storage conditions (temperature, RH, modified atmosphere, light, chemical damage…)

2.Food Process Engineering
2.1.Transport processes
Fluid flow (turbulent, laminar, Newtonian, non-Newtonian)
Heat transfer and mass transfer (combined for example in the case of drying)
Thermodynamics, equilibrium
2.2.Separation processes (Laws, calculation)
Filtration, centrifugation, membrane processes, evaporation/concentration, distillation, extraction, ion exchange
2.3.Reaction engineering
2.4.Modeling and simulation

3.Food Plant Design
3.1.Food process control
Setpoint control, sequential control; industrial computer applications; supervision; optimisation
Measurement and control (sampling, sensors, data handling)
3.2.Utilities
Refrigeration, steam generation, water and waste, electricity

Food management and business

1. Economics
- macroeconomic, microeconomics, industrial

2. Operations management

- inventory control, process flow design, distribution, handling, risk assessment, etc.

3. Accounting
- financial accounting : corporate, profit/loss, tax, etc.
- cost accounting : fixed vs variable costs

4. Marketing
- sales, advertising, innovation management
Operations research
- statistical, optimal modeling
Decision making models (logistical)
Simulations

Integrated Experience

1. Capstone course or other project integrating different aspects of food science and technology.

Food Studies = 4 years Discipline	% Credits	Credits ECTS	% Total
Fundamental science			
1.Mathematics	22	18	
2.Computer science	7.3	6	
3.Physics	14.6	12	
4.Chemistry	22	18	
5.Biology	14.6	12	34%
6.Elements of material sciences	3.6	3	
7. Languages	11	9	
8.Communication skills	4.9	4	
TOTAL	**100**	**82**	
Food chemistry and analysis, and nutrition			
1.Food chemistry and biochemistry	36.4	8	
2.Food physics	13.6	3	
3. Food analysis	36.4	8	9%
4.Nutrition	13.6	3	
TOTAL	**100**	**22**	
Food safety and microbiology and environment			
1. Food microbiology	29.4	5	
2. Quality assurance	17.6	3	
3. Industrial microbiology	17.6	3	7%
4. Food toxicology	17.6	3	
5. Environment	17.6	3	
TOTAL	**100**	**17**	
Food engineering and technology			
1. Food manufacturing technology	24.1	7	
2. Food process engineering	55.1		
2.1 Transport processes		6	
2.2 Separation processes		4	
2.3 Reaction engineering		3	14%
2.4 Modeling and simulation		3	
3. Food plant design	20.7		
3.1 Food process control		3	
3.2 Utilities		3	
TOTAL	**100**	**29**	
Food management and business			
1. Economics	33.3	9	
2. Operations management	22.2	6	
3. Accounting	22.2	6	11%
4. Food marketing	22.2	6	
TOTAL	**100**	**27**	
Integrated Project		**3**	
Optional (25%)*		**60**	**25%**
TOTAL		**240**	**100%**

- additional courses may be used to provide greater emphases in specific areas (i.e., nutrition, safety, etc.) specific commodities (i.e., dairy, vegetables, etc.) or to provide broader liberal arts education