# Template for summary of Tuning subject area findings

FOOD STUDIES

## Introduction to the subject area

Food Studies is a multidisciplinary area that overlaps with other subjects that are themselves the object of European networks, as the cases of Engineering and Chemistry. It is the belief of the ISEKI network that to define criteria for quality assurance for food related programmes, with respect to curricula definition, food science experts' opinions must be taken into account.

A large variety of the graduates' profiles can be found in each country. These range from Chemistry based curricula, to Engineering or Technology based curricula, with different institutions in the same country offering these different slants. The programmes may also be focused on specific related sectors such as oenology, meat science, brewing science. No trend was observed relating to the choice of the kind of programme for any particular country.

Food studies comprise a large variety of programmes of which the central core is food processing and food preservation. The grasp of the key concepts of these topics requires a strong basis of food chemistry, food microbiology, physical properties of foods and transport processes (heat, mass and momentum). The typical first cycle programme, which can be designated as being Food Science and Technology, has to offer a solid, concise, yet comprehensive, delivery of these subjects. This curriculum design and content has to clearly take into account the strong multidisciplinary characteristic of food studies programmes. Thus, a good background of basic disciplines, as biology, chemistry, mathematics and physics, is essential for food studies students. Each programme may then develop different subjects to different extents. For example, Food Chemistry programmes, will obviously focus more on the chemistry field, but food microbiology and transport processes should not be excluded; hence a there should, at least, be a token presence as a minor module in the curricula.

The inclusion of sensory analysis, packaging, safety, environmental sciences, quality control, nutrition, completes the picture of topics that should be incorporated into Food Science and Technology programmes. Food Engineering degrees, in the first cycle, can devote a considerable portion of the curricula to engineering sciences, but, in the second cycle, have to include other chemistry and biology subjects (microbiology included) together with management and economics topics of relevance.

**Degree profile(s)**

Typical degrees offered in the subject area

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| • First cycle<br>BSc in FOOD SCIENCE AND TECHNOLOGY |
| • Second cycle<br>MSc in FOOD SCIENCE |
| • Third cycle<br>PhD in FOOD SCIENCE/BIOTECHNOLOGY/NATURAL SCIENCES/AGRICULTURAL SCIENCES |

Typical occupations of the graduates in the subject area

- First cycle and Second cycle
  The occupations of food studies graduates can be grouped by the kind of activity they perform and the sector of activity as shown in the table below.

| **Sectors** | **Activities** |
|---|---|
| Food industry | Production |
| Cosmetics | R&D |
| Consulting | Consulting |
| Pharmaceutics | Quality |
| Trade | Marketing |
| Computers | Trade |
| Public sector (food control) | Technical Assistance |
| Marketing | Informatics |
| Others | Others |

- Third cycle
  A Doctoral graduate can work as a researcher in industry and research institutes or as academic staff in a university. Project management or consultancy could also serve as possible occupations.

Role of subject area in other degree programmes

A large number of programmes are related to food studies, these include Nutrition, Chemical Engineering, Agricultural Engineering, Consumer Sciences, Biotechnology, Veterinary, Health (Environmental, Public), Chemistry, Materials Science, Pharmacy (Herbal Technology, Pharmaceutical Technology, Cosmetic Products Technology),

Packaging Technology, Automation and Informatics, Economics and Management, and others.

Some of these programmes are completely related to food, as Nutrition, which must offer the student an insight into processing and preservation of food. This would provide the graduates with necessary competences related to food.

Other programmes may not need to approach food at all, as is the case with Materials Science. The choice of subject may also be affected by availability of lecturers of that subject in the institution or a consequence of the employment market.

## Learning outcomes & competences - level cycle descriptors

- First cycle and Second cycle

The generalised lack of familiarity of European higher education teachers with learning outcomes/competences based teaching, makes the task of provision these lists very hard and less meaningful than one could wish. The generic competences were selected from the list of the Tuning project and those considered most relevant for first and second cycle where the following:

- Basic knowledge of the field of study
- Basic knowledge of the profession
- Capacity for analysis and synthesis
- Capacity for applying knowledge in practice
- Capacity for generating new ideas (creativity)
- Capacity to adapt to new situations
- Capacity to learn

Due to the multidisciplinary nature of food studies and to the already referred variability between graduates' profiles, a large range of competences can be found. In the table below the typical competences that can be found in first and second cycle graduates are presented. The level to which the competences must be developed is not specified because these vary according to the programme.

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| First cycle | 1. Have knowledge of food chemistry to control reactions in foods during processing and storage.<br>2. Understand the principles behind analytical techniques associated with food.<br>3. Be able to use the laboratory techniques common to basic and applied food chemistry. |

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| | 4. Utilize laboratory techniques to identify microorganisms in foods.<br>5. Understand the principles involving food preservation processes.<br>6. Understand the role and significance of microbial inactivation, adaptation and environmental factors (i.e., aw, pH, temperature) on growth and response of microorganisms in various environments.<br>7. Be able to identify the conditions, including sanitation practices, under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods.<br>8. Explain the role of nutrients in health.<br>9. Understand the principles that make a food product safe for consumption.<br>10. Understand the transport processes and unit operations in food processing as demonstrated both conceptually and in practical laboratory settings.<br>11. Be able to use the mass and energy balances for a given food process.<br>12. Understand the unit operations required to produce a given food product.<br>13. Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality.<br>14. Be able to apply statistical principles to food science applications.<br>15. Be knowledgeable of current topics of importance to the food industry.<br>16. Be able to follow regulations required for the manufacture and sale of food products and assess the performance of a process and the conformance of food to specifications and legislation.<br>17. Understand the basic principles and practices of cleaning and sanitation in food processing operations.<br>18. Understand the requirements for water utilization and waste management in food and food processing.<br>19. Explain characteristics and properties of packaging materials for food products. |
| Second cycle | 1. Be able to select the appropriate analytical technique when presented with a practical problem.<br>2. Describe physical properties of food and experimentally determine their values.<br>3. Identify the important pathogens and spoilage microorganisms in foods and the conditions under which they will grow. Identify the conditions under which the important pathogens are commonly inactivated, killed or made harmless in foods.<br>4. Demonstrate capability of management of a food quality control laboratory. |

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| | 5. Describe biochemical, chemical, physical and biological factors underlying the synthesis and metabolism of food materials.<br>6. Describe the risks to health of chemical contaminants of food and outline appropriate methods for risk reduction.<br>7. Understand the source and variability of raw food material and their impact on food processing operations.<br>8. Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage.<br>9. Evaluate engineering design of food equipment and communicate professionally with specialist food engineers.<br>10. Identify appropriate packaging systems.<br>11. Know how to use computers to solve food science problems.<br>12. Understand and be able to apply quality assurance principles for food safety.<br>13. Design, apply and interpret statistically valid sensory evaluation methods to assess food quality and/or preference.<br>14. Understand the quality management system in food industry. |

- Third cycle

No work has been performed to establish a list of competences for the third cycle (PhD).

Generalised level descriptors, such as the Dublin Descriptors, were not subject of discussion yet in the ISEKI network.

## Consultation process with stakeholders

The consultation process with stake holders is highly variable from country to country. Though there is a common trend in the way by which contacts established for research projects are established. Furthermore, academics involved in this process seem to have a better perception of the society needs. Other, less common, consultation processes include boards constituted by students, food industry, professional association, teachers and parents association that meet one to two times per year, at local level (Italy); in Spain, a university level commission with industry representatives is consulted for curricula planning; in Belgium, a graduate association is consulted every five years; in Poland, food industry and professional associations are consulted for curricula planning. This is an area that needs further elaboration and promises extensive programme improvements.

**Workload and ECTS**

Workload of the typical degree programmes expressed in ECTS-credits:

- First cycle
  A typical BSc degree has 180 ECTS credits.
- Second cycle
  A typical MSc degree has 120 ECTS credits.
- Third cycle
  A PhD degree has between 180 and 240 ECTS credits.

Trends and differences within the European higher education area in this subject area.
No trend has been noticed apart from the one common to most subjects of providing a first cycle with 180 ECTS and a second cycle with 120 ECTS. Though, in Poland first cycle is providing with 210 ECTS and a second cycle with 90 ECTS.

**Learning, teaching & assessment**

The examples are taken from a book dedicated to presenting examples of personal skills development, prepared in a previous Erasmus network (FOODNET).

1. Understand the principles that make a food product safe for consumption.

In a discipline whose fundamental aims are to show food processing as a part of food chain, to show the need for safety along the whole chain for the production of safe and healthy foods, and learn to recognize the potential safety risks of the different phases of the food chain.

The teaching methods are lecturing and showing videos about the subject matter and problem-solving tasks in a team. Each team has 4 to 5 members and division of tasks is left to the group. The team is asked to solve a problem of food poisoning. They must find out:

- Why that kind of epidemic would occur;
- The actual reason for poisoning;
- At what phase of the food chain the mistake was made.

Students must present the solution in a joint meeting with the teacher and prepare a written report. The report is evaluated for clarity, essential matters described, good argumentation and understanding the character of the food chain.

One third of the final discipline mark is given by the report grade and other two by a written exam.

2. Various competences developed: integration of knowledge of different disciplines (food processing, food chemistry, food microbiology, etc.), application of statistical principles to food science applications, etc.

In a discipline that deals with food product development, students attend lectures and work in groups of two to six in collaboration with food companies on real-life product development or trouble-shooting projects. Their tasks include gathering information from trade, scientific journals and internet, using statistical experimental design and communicating with company representatives. They are expected to deliver a product and are required to prepare a clear, concise, grammatically correct and technically accurate written report. An oral presentation is also given to the food company as well as to students and lectures participating in the course. Students are assessed by means of oral presentation, written report and written exam.

3. Evaluate engineering design of food equipment and communicate professionally with specialist food engineers.

A discipline that includes applied thermodynamics consists of lectures, exercises/calculations and a project. Groups of 3 to 4 students find an example of heat or refrigeration system and meet the responsible person for it to get information on the equipment (how it works, its role, control, maintenance). Examples are heat network in a city, cold shells for food products, vending machine, truck for frozen food, etc. Students must prepare a poster and written report of which they are assessed. Assessment is completed with a written exam.

## Quality enhancement

1. Definition of academic and professional profiles: translation into learning outcomes and generic subject-specific competences

Most often, the definition of academic and professional profiles is made by academics and is based on their perception of the society needs as a result of the different types of interaction they have. In the examples given of the consultation with stakeholders, they may also have direct influence on the definition of graduate profiles.

2. Translation into curricula

The ISEKI network established minimum requirements (discipline/topics and workload in ECTS credits) for a first cycle in food studies. These are not competence associated but were established on a basis of knowledge/subject contact that any graduate in food studies must have. Other organisations also supply guidelines for curricula content (International Union of Food Science and Technology (international), Quality Assurance Agency for Higher Education (UK), Institute of Food Technologists (USA)).

3. Translation into modules and approaches towards teaching, learning and assessment

Active learning and generic competences development has been object of interest among this field. In fact, in the first network related to food studies, FOODNET, a book with examples of active learning and generic competences development was prepared.

4. Programme quality assurance: built in monitoring, evaluation and updating procedures

Consultations of students during their studies and of graduates with professional experience are the main examples of monitoring of the different degrees. This is a key issue requiring a uniform approach, resulting to comparable outcomes across different countries.