INSTITUTE OF FOOD TECHNOLOGISTS
Application for Approval
of the Undergraduate Degree in Food Science (FS) at University College Cork

I. Date of application submission  ______29th August, 2011_________

II. Name of person completing this application  Kevin Cashman¹, Yrjö H. Roos² & Eileen O’Neill³
[Submission coordination team]

Professional title: ¹Professor of Food and Health
                  ²Professor of Food Technology
                  ³Senior Lecturer in Food Chemistry [BSc FS programme coordinator]

Mail address: School of Food and Nutritional Sciences
              University College Cork
              Cork
              Ireland

Email address: k.cashman@ucc.ie
Office phone number: +353 21 4901317
Fax number: +353 21 4270244

III. Description of administrative unit

A. Name of Institution:  University College Cork
B. Name of College:  College of Science, Engineering and Food Science
C. Name of School:  School of Food and Nutritional Sciences
D. Name of Head of School:  Professor Kevin Cashman

E. All undergraduate degrees (including emphases) granted by the School
   (e.g., BS in Food Science, BS in Food Technology with Food Industry Emphasis, BS in Nutritional Science)

   BSc Food Science (Food Chemistry and Processing Technology (Option))
   BSc Food Science (Food Microbiology (Option))*
   BSc Nutritional Sciences (accredited by the UK Association for Nutrition since 2008; first
   programme outside the United Kingdom to be accredited).

*In conjunction with the School of Microbiology (awarding academic unit).

F. Of those above, degree(s) (including emphases) to be evaluated for IFT approval

   BSc Food Science (Food Chemistry and Processing Technology (Option))

G. Other information relevant to this application for IFT approval
   The four-year honours BSc Food Science programme at University College Cork is administered
   by an independent administrative unit, i.e., the School of Food and Nutritional Sciences. The
   School has an identifiable budget to support this programme.
IV. Description of faculty (1-2 pages)

A. Faculty teaching core Food Science modules (within the School of Food and Nutritional Sciences (#1-10) – which is the anchor academic unit for the programme; School of Microbiology (#11,12); School of Chemical and Process Engineering (#13)) (place an asterisk by course numbers of required courses)

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Degree</th>
<th>Appointment</th>
<th>Specialization(s)</th>
<th>Courses Taught*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Yrjö H. Roos</td>
<td>PhD*</td>
<td>Professor</td>
<td>Food Engineering, Food Science, Food Technology</td>
<td>FS3001; FS3003; FS3006; FS3007; FS4002; FS4010</td>
</tr>
<tr>
<td>2.</td>
<td>Daniel Mulvihill</td>
<td>PhD</td>
<td>Associate Professor</td>
<td>Food Chemistry, Food Science, Food Technology</td>
<td>FS2003; FS2004; FS3001; FS3002; FS3005; FS4001; FS4003; FS4023</td>
</tr>
<tr>
<td>3.</td>
<td>Paul McSweeney</td>
<td>PhD*</td>
<td>Associate Professor</td>
<td>Food Chemistry</td>
<td>FS2002; FS3002; FS3004; FS4001; FS4003; FS4020; FS4022</td>
</tr>
<tr>
<td>4.</td>
<td>Elke Arendt</td>
<td>PhD*</td>
<td>Associate Professor</td>
<td>Food Technology</td>
<td>FS3001; FS4002; FS4006</td>
</tr>
<tr>
<td>5.</td>
<td>alan Kelly</td>
<td>PhD</td>
<td>Associate Professor</td>
<td>Food Technology, Food Science</td>
<td>FS3003; FS3006; FS3007; FS4002; FS4014; FS4020</td>
</tr>
<tr>
<td>6.</td>
<td>Tom O'Connor</td>
<td>PhD</td>
<td>Senior Lecturer</td>
<td>Food Chemistry/Nutrition</td>
<td>FS2002; FS2004; FS3001; FS3003; FS4001; FS4003; FS4022; NT2004; NT4010</td>
</tr>
<tr>
<td>7.</td>
<td>Eileen O'Neill</td>
<td>PhD</td>
<td>Senior Lecturer</td>
<td>Food Chemistry</td>
<td>FS1001; FS2001; FS2002; FS3001; FS3002; FS3004; FS4001; FS4003; FS4021</td>
</tr>
<tr>
<td>8.</td>
<td>Joe Kerry</td>
<td>PhD</td>
<td>Senior Lecturer</td>
<td>Food Technology</td>
<td>FS2004; FS3006; FS3008; FS4002; FS4011; FS4011</td>
</tr>
<tr>
<td>9.</td>
<td>Seamus O'Mahony</td>
<td>PhD</td>
<td>Lecturer</td>
<td>Food Science</td>
<td>FS2003; FS2004; FS3001; FS3007; FS4001; FS4003; FS4014</td>
</tr>
<tr>
<td>10.</td>
<td>Tim Guinee</td>
<td>PhD</td>
<td>Adjunct Professor**</td>
<td>Food Science</td>
<td>FS3005</td>
</tr>
<tr>
<td>11.</td>
<td>Gerald Fitzgerald*</td>
<td>PhD</td>
<td>Professor</td>
<td>Food Microbiology</td>
<td>FS3001; MB3003;</td>
</tr>
</tbody>
</table>
MB3014

12. Colin Hill* PhD Professor Microbial Food Safety FS1001; MB4011
13. Jorge Oliveira PhD Senior Lecturer Food Science and Engineering PE2006; PE2007

§All appointed as full-time, permanent (tenured) academic appointments, except Dr Tim Guineen**, who has a adjunct appointment at Professorial level in the School of Food and Nutritional Sciences, but employed by Teagasc (The Irish Agriculture and Food Development Authority).

*Also awarded a DSc (Doctorate of Science on basis of published literature).

†All of these modules (courses) are required FS courses.

B. Additional faculty involved in delivery of the BSc Food Science programme (within the School of Food and Nutritional Sciences) (place an asterisk by course numbers of required courses)

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Highest Degree</th>
<th>Appointment†</th>
<th>Specialization(s)</th>
<th>Courses Taught</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kevin Cashman</td>
<td>PhD</td>
<td>Professor</td>
<td>Food &amp; Health</td>
<td>FS1001*; FS3001*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Nutrition</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Albert Flynn</td>
<td>PhD</td>
<td>Associate Professor</td>
<td>Nutrition</td>
<td>FS3001*</td>
</tr>
<tr>
<td>3</td>
<td>Nora O'Brien</td>
<td>PhD</td>
<td>Associate Professor</td>
<td>Nutrition</td>
<td>FS3001*; NT2004*; NT4010*</td>
</tr>
<tr>
<td>4</td>
<td>Mairead Kiely</td>
<td>PhD</td>
<td>Senior Lecturer</td>
<td>Nutrition</td>
<td>FS3001*</td>
</tr>
<tr>
<td>5</td>
<td>Tony Sheehy</td>
<td>PhD</td>
<td>Lecturer</td>
<td>Nutrition</td>
<td>FS3001*</td>
</tr>
<tr>
<td>6</td>
<td>Aoife Ryan</td>
<td>PhD</td>
<td>Lecturer</td>
<td>Nutrition</td>
<td>FS3001*</td>
</tr>
</tbody>
</table>

§All appointed as full-time, permanent (tenured) academic appointments.

Note: The School of Food and Nutritional Sciences (academic home of the BSc Food Science) is also supported by 12 permanent technical and support staff (2 job-sharing) and 4 permanent administrative staff (2 job-sharing).

C. Any extenuating circumstances regarding faculty that should be considered: None.
V. Description of facilities

A. If available, specific website describing School facilities:

http://www.ucc.ie/en/fns/DescriptionofSchoolFacilitiesRelIFT/

Note: We have also provided as Appendix I for ease of consultation for HERB

Brief overview

The School of Food and Nutritional Sciences is based largely in the Food Science and Technology Complex in UCC where it occupies extensive teaching and research laboratories as well as a pilot scale Food Processing Hall (School footprint: ~3824 m²). While much of the space is wet-laboratory in nature, the School has some specialized units, such as a food materials science laboratory, food packaging laboratory, cheese research laboratory, tissue culture facility; human dietary studies/clinical facility; sensory kitchen and sensory laboratory, as well as specialized areas within the processing hall (see Section D below). Please see website above (or Appendix I) for photographic portfolio.

B. Equipment available for teaching undergraduates in the program.

The laboratory equipment is typical of that found in the food science/nutrition area. The laboratory and pilot plant equipment available for teaching undergraduate programmes is complemented by a large suit of analytical equipment used as part of the many research programmes run by academic staff members. Please note that while the students may not get hands-on experience of the following list of equipment, they may get demonstration sessions of some of the equipment as part of their undergraduate programme. The equipment available includes various types of spectroscopy (visible, UV, fluorescence), chromatography (ion exchange, gel permeation, reversed phase etc with some linked to mass spectrometry), microscopy (light, polarised light, hot/cold stage, confocal scanning electron), rheology (viscometry, rheometry, rapid viscoanalyzer, uniaxial compression/extension), thermal analysis (differential scanning calorimetry, dynamic mechanical analysis, dielectric analysis), titration (pH stat, acid-base buffering), Karl Fischer titration for moisture analysis, controlled environtal chambers (temperature, humidity, light, with data logging capability), electrophoresis (preparative and analytical 1-D and 2-D, densitometry), pycnometer (particle density, interststitial and occluded air), bulk volume meter, particle size analysis (sieve stack, Mastersizer, Zetasizer), surface/zeta potential analyser, accelerated stability analyser (LumiSizer), 2-stage valve homogeniser, scraped-surface heat exchanger, pilot scale tubular heat exchanger with in-line 2-stage valve homogeniser, clean fill hood and data logging capability for HTST/UHT, high pressure processing unit, high pressure homogeniser, sonicator, hydraulic press (cheese juice), viscubator batch thermal processing unit, spray dryer (Bucchi bench top unit and Niro single stage pilot plant unit – 10 Kg/h WEC), pilot scale evaporator, pilot-scale pasteurisation plant (600 LPH), cheese vats (20 L and 100 L), vacuum packaging equipment, retort sterilisation unit, pilot scale membrane filtration plants (ultrafiltration and microfiltration), solubility index meters, refractometers, colorimeter, polarimeter, laboratory-scale freeze dryer, analytical centrifuges (including refrigerated and ultracentrifuges), radiation counting, ELISA, molecular biology, clinical auto-analysers, uPLC-MS/MS, ToF-MS, DEXA scanner, rheofermentometer, volume determination, glutomatic, moisture analyser, aw-meter, farinograph, extensiograph, , SCABA, Leco, Kjeldahl, Soxhlet, rapitec-beer analyser, mash-bath, DLSU-mill, visco-meter, haze-analysers, plansifter, NIBEM-head-retention, O₂-determination, heligecompartor, pressure filtration unit, CO₂ detection systems

C. Teaching laboratories (include food chemistry/analysis, food microbiology, food engineering)

The School has a dedicated undergraduate teaching laboratory in the nutrition area (~100 m²) and another in the food science/food chemistry area (~120 m²) (both of these are currently undergoing a
€0.5 million refurbishment scheme). These generally service the 1st to 3rd year students, whereas final year students usually conduct their honours research projects in more dedicated research/postgraduate laboratories as well as in areas of the food processing hall. The undergraduate laboratories service areas such as food chemistry and analysis, food physics/engineering, food technology. There are also dedicated laboratories in the School of Microbiology for laboratory sessions associated with undergraduate food microbiology courses.

D. Pilot plant/processing capabilities

The dedicated Processing Hall (~1000 m²) within the School of Food and Nutritional Sciences has the following specialized areas: pilot-scale cereal and beverage processing facilities (consisting of milling, malting and processing equipment as well as analytical equipment ranging from texture and rheological to image analysis), dairy technology area, high pressure treatment unit, product stability and delivery systems (dehydration, including freeze-drying and spray drying; extrusion; membrane processes; pasteurisation, UHT and thermal processing), meat processing hall, food packing areas, shelf-life and stability testing, as well as a good manufacturing plant facility (GMP) for production of food/clinical trial-grade dairy-based lactobacillus and bifidobacterium (operated by the School of Microbiology).

E. Explanations of accessibility if above facilities are not in-School or on-campus

The above facilities and equipment are within the School of Food and Nutritional Sciences, therefore, Food Science staff and students have priority access. In addition to internal resources, the School of Food and Nutritional Sciences is a member of the Biofunctional Food Engineering (BFE) facility established in 2006 at Teagasc Food Research Centre Moorepark (The Irish Agriculture and Food Development Authority; the national body providing integrated research, advisory and training services to agriculture and the food industry, and which is located just 40 min drive from University College Cork (UCC)). The BFE is an integrated pilot-scale facility designed to address scientific and industry research in food process technology and stabilization/incorporation of sensitive ingredients in food & beverages. This facility provides the Food Science staff and students within the School with direct access to equipment not available in the pilot plant at UCC. Examples of such equipment include pilot scale chromatography equipment, supercritical fluid extraction, microfluidizer, encapsulation, larger-scale evaporation and multi-stage spray drying facilities. A strategic alliance in food research between UCC and Teagasc also provides UCC Food Science staff and students with priority access to facilities at Teagasc which compliment those at UCC; an example being the microstructural characterisation equipment available in the National Food Imaging Centre (e.g., scanning electron microscopy, atomic force microscopy and confocal scanning laser microscopy) located at Teagasc Food Research Centre Moorepark.

F. Any extenuating circumstances regarding facilities that should be considered: None
VI. Description of curriculum (2 pages)

The BSc Food Science at University College Cork is a 4-year honours degree programme consisting of 60 credits per year (240 credits for full programme). A 5-credit course (called ‘module’) is the primary academic block and would generally consist of 24 hours of lectures and may or may not have associated laboratory sessions (see below). Please see Appendix II for overview of the programme and its modules (courses).

A. Specific website containing course descriptions for both background and School courses:  
http://www.ucc.ie/modules/descriptions/FS.html

Note: We have also provided as Appendix III for ease of consultation for HERB.

B. Required courses in each of the following background subjects (Note: these are all compulsory modules/courses within the Food Science programme):

<table>
<thead>
<tr>
<th>School(s)</th>
<th>Number (code)</th>
<th>Credit*</th>
<th>Lab included (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemistry</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Chemistry</td>
<td>Chemistry</td>
<td>CM1005</td>
<td>15 credits</td>
</tr>
<tr>
<td>including Organic Chemistry</td>
<td></td>
<td></td>
<td>Yes (50 x 1 h)</td>
</tr>
<tr>
<td>Biochemistry:</td>
<td>Biochemistry</td>
<td>BC2001</td>
<td>5 credits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BC2002</td>
<td>5 credits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes (3 x 4 h)</td>
</tr>
<tr>
<td>Other Chemistry courses</td>
<td>Microbiology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(see Food Science (FS) courses below)</td>
<td>MB2003</td>
<td>10 credits</td>
<td>Yes (5 x 3 h)</td>
</tr>
</tbody>
</table>

| **Biological Sciences** | |         |                      |
| Biology               | Various       | BL1002  | 5 credits           |
|                       |               | BL1003  | 5 credits           |
|                       |               | BL1004  | 5 credits           |
| General microbiology  | Microbiology  | MB2003  | 10 credits          |
| (including lab)       |               |         | Yes (5 x 3 h)      |
| Food microbiology     | Microbiology  | MB3003  | 5 credits           |
|                       |               | MB3014  | 5 credits           |
|                       |               | MB4011  | 5 credits           |
|                       |               |         | Yes (4 x 4 h)      |
|                       |               |         | Yes (4 x 3 h)      |
|                       |               |         | No                  |

| **Human Nutrition**  | School Food & Nutr Sci | NT2004  | 5 credits | No |
|                      | NT4010          |         |           |    |

| **Physics**          | Physics         | PY1008  | 10 credits | Yes (6 x 3 h) |
| General physics      |                |         |            |               |
| Other physics courses| Proc & Chem     | PE2006  | 5 credits  | Yes (7 x 2 h) |
| (Process/Food Engineering) | Engineering | PE2007  | 5 credits  | Yes (6 x 2 h) |

| **Mathematics**      | School of Maths | MA1003  | 10 credits | No |
| Math and applied math|                |         |            |    |
| (including calculus and statistics) | | | | |

| **Statistics**       | School of Maths | ST2001  | 5 credits  | Yes (10 x 1 h) |
| Biostatistics        |                |         |            |               |

| **Communications**   | School Food & Nutr Sci | All FS modules | 10 credits | N/A |
| Written              | FS3001/ FS4001/2 |         |             |    |
| Oral                 |                | FS3001/2 | 10 credits  | N/A |

C. Any extenuating circumstances regarding background courses that should be considered: None
VI. Description of curriculum – cont.

D. **Required** courses (excluding background courses), listed in numerical order

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Credit</th>
<th>Hours*</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS1001</td>
<td>24 L, X 32 h lab</td>
<td><em>Introduction to Food Science and Technology</em></td>
<td></td>
</tr>
<tr>
<td>FS2001</td>
<td>24 L, X 80 h lab</td>
<td><em>Introductory Food Chemistry - Analytical Methods</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 h Tutorials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FS2002</td>
<td>24 L</td>
<td><em>Introductory Food Chemistry: Food Constituents</em></td>
<td></td>
</tr>
<tr>
<td>FS2003</td>
<td>24 L, X 12 h lab</td>
<td><em>Introductory Food Chemistry - Selected Topics in Physical Chemistry</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 h Tutorials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FS2004</td>
<td>24 L</td>
<td><em>Topics in Food Quality and Legislation A</em></td>
<td></td>
</tr>
<tr>
<td>FE1301</td>
<td>24 L</td>
<td><em>Introduction to Food Supply Chains</em></td>
<td></td>
</tr>
<tr>
<td>PE2006</td>
<td>24 L, 14 h lab</td>
<td><em>Process Engineering Principles</em></td>
<td></td>
</tr>
<tr>
<td>FS3001</td>
<td>24 week</td>
<td>[22-week full-time] Work Placement</td>
<td></td>
</tr>
<tr>
<td>FS3002</td>
<td>24 L, X 18 h lab</td>
<td><em>Chemistry of Food Proteins</em></td>
<td></td>
</tr>
<tr>
<td>FS3003</td>
<td>24 L, X 12 h lab</td>
<td><em>Chemistry and Technology of Oils and Fats</em></td>
<td></td>
</tr>
<tr>
<td>FS3004</td>
<td>24 L, X 9 h lab</td>
<td><em>Sensory Analysis, Flavour and Colour</em></td>
<td></td>
</tr>
<tr>
<td>FS3005</td>
<td>24 L, X 15 h lab</td>
<td><em>Macromolecules and Rheology</em></td>
<td></td>
</tr>
<tr>
<td>FS3006</td>
<td>48 L, X 26 h lab</td>
<td><em>Food Processing and Preservation</em></td>
<td></td>
</tr>
<tr>
<td>FS3007</td>
<td>24 L, X 9 h lab</td>
<td><em>Dairy Product Technology</em></td>
<td></td>
</tr>
<tr>
<td>FS3008</td>
<td>24 L, X 6 h lab</td>
<td><em>Fundamentals of Food Packaging</em></td>
<td></td>
</tr>
<tr>
<td>MB3003</td>
<td>24 L, X 16 h lab</td>
<td><em>Food and Industrial Microbiology I</em></td>
<td></td>
</tr>
<tr>
<td>MB3014</td>
<td>24 L, X 12 h lab</td>
<td><em>Food and Industrial Microbiology II</em></td>
<td></td>
</tr>
<tr>
<td>MB4011</td>
<td>24 L</td>
<td><em>Microbial Food Safety</em></td>
<td></td>
</tr>
<tr>
<td>FS4006</td>
<td>24 L, X 24 h lab</td>
<td><em>Cereals and Related Beverages</em></td>
<td></td>
</tr>
<tr>
<td>FS4010</td>
<td>24 L</td>
<td><em>Food Shelf Life Control</em></td>
<td></td>
</tr>
<tr>
<td>FS4011</td>
<td>24 L</td>
<td><em>Advanced Food Packaging</em></td>
<td></td>
</tr>
<tr>
<td>FS4020</td>
<td>24 L, X 12 h lab</td>
<td><em>Dairy Science and Technology</em></td>
<td></td>
</tr>
<tr>
<td>FS4021</td>
<td>24 L, X 24 h lab</td>
<td><em>Meat Science and Technology</em></td>
<td></td>
</tr>
<tr>
<td>FS4022</td>
<td>24 L</td>
<td><em>Topics in Food Science</em></td>
<td></td>
</tr>
<tr>
<td>FS4023</td>
<td>24 L, X 3 h Tut</td>
<td><em>Food Biopolymer Ingredients and Mixtures</em></td>
<td></td>
</tr>
</tbody>
</table>

Internal choice within the required FS modules (students must take either FS4001 or FS4002 – as final year honours research project; and each project module has an associated compulsory module which the students must take):

- **FS4001** 20 weeks *Research Project*
- + **FS4003** 40 h lab *Advanced Analytical Methods*
- or
- **FS4002** 18 weeks *Team Product Development Project*
- + **FS4014** 24 L *Food Product Development and Innovation*

* L = 1 hour lecture; Lab = laboratory practicals; Tut = Tutorial.

E. **Elective** courses offered, listed in numerical order. *None*
VII. Coverage of IFT Core Competencies (1 spreadsheet or checklist)

A. Where each of the IFT Core Competencies is covered within the curriculum of required food science courses

Please see following pages for completed IFT core competency template

Please see also Appendix II which maps the key required courses (modules) to the IFT core competencies.
VIII. Course outcomes and assessments (1-3 pages per course)
For each required food science course:

Explanatory note to HERB: We have developed Module Learning Outcomes (outlined below for each required Food Science (FS) course), these were approved at School level and also by the Faculty of Food Science & Technology, and ultimately at University level.

FS1001 Introduction to Food Science and Technology

Objective of module: To provide students with an introduction to key aspects of Food Science and Technology.

Brief overview of modules content: Aspects of the chemistry, microbiology and processing of foods.

A. Specific learning outcomes, including how the course addresses the core competencies (as listed for the course in Part VII).

1. Outline the main ways in which primary production of food is of importance to food product quality
2. Describe the general features and importance of proteins, lipids and carbohydrates in foods
3. Describe the reasons why food is processed
4. Apply the above basic knowledge of food ingredients and processing operations to describe how cheese, emulsions and milk powder are made
5. Discuss the concept of functional foods
6. Explain food and nutritional labeling
7. Identify the important roles, both beneficial and detrimental, played by micro-organisms in the food industry
8. Explain the costs and consequences of food-borne disease.

How the course addresses the core competencies:
This introductory module (course) addresses the following core competencies:

Food Chemistry and Analysis
It cross-connects to the following content areas within this competency:
- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives

Food Safety and Microbiology
It cross-connects to the following content areas within this competency:
- Pathogenic and spoilage microorganisms in foods
- Beneficial microorganisms in food systems

Success skills
It cross-connects to the following content areas within this competency:
- Communication skills
- Information acquisition skills
- Organisational Skills

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., ‘By the completion of food science program, the student should’):
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- Understand the chemistry underlying the properties and reactions of various food components.
- Have sufficient knowledge of food chemistry to control reactions in foods.
- Identify the important pathogens and spoilage microorganisms in foods and the conditions under which they will grow.
- Understand the principles involving food preservation via fermentation processes.
- Demonstrate the use of oral and written communication skills.
- Independently research scientific and nonscientific information.
- Competently use library resources.
- Manage time effectively.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

Tools used to assess learning outcomes (% total mark):  Level of assessment (Bloom’s taxonomy)
End of year written 1.5 h examination (90%)  I-II
Minor project written report and oral presentation (10%)  IV,V

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)
Average mark (out of 100): 55-58
Minimum: 24-30
Maximum: 82-89
% failure at first sitting: 9-16%

This module was introduced a few years ago to provide students with an insight into the Food Science area at an early stage of the undergraduate programme. Student feedback indicated that students appreciate this opportunity to study introductory Food Science as the majority of the other modules they take in first year deal with the basic sciences and mathematics. It is also a useful mechanism whereby the academic staff of the School have direct contact on a weekly basis. Students learn by lectures and oral student presentations. All module lectures are provided in either manuals or are available on the University e-learning portal, 'Blackboard'.
FS2001  *Introductory Food Chemistry - Analytical Methods*

**Objective of module:** To provide an introduction to basic concepts and applications of analytical techniques relevant to Food Chemistry.

**Brief overview of modules content:** Volumetric analysis (acid-base, argentimetric, redox and complexometric titrations using indicators and potentiometric end-point determination). Electrochemical analysis (conductimetry, coulometry). Spectroscopy (visible, UV, atomic absorption). Flame photometry and fluorimetry. Polarimetry and refractometry. Chromatography

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Describe the behaviour of acids, bases and buffers
2. Calculate the concentration of solutions and be able to prepare standard solutions
3. Outline the principle and procedures involved in the determination of the concentration of salt in foods
4. Balance redox equations
5. Outline the principles involved in the use of redox titrations to determine (i) the concentration of reducing sugars, (ii) the available chlorine in bleach and (iii) the polluting potential of waste water
6. Describe the use of complexiometric titrations to determine water hardness
7. Outline the principle and applications of electrochemical analytical techniques
8. Describe the principle and applications of spectroscopy and chromatography in food analysis
9. Carry out appropriate experiments safely in the laboratory, make accurate observations and write scientific reports.

**How the course addresses the core competencies:**

This module (course) addresses the following core competencies:

**Food Chemistry and Analysis**

It cross-connects to the following stated content areas within this competency:

- Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients.
- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives

**Applied Food Science**

It cross-connects to the following stated content areas within this competency

- Integration and application of food science principles
- Computer skills

**Success Skills**

- Communication skills
- Critical thinking/problem solving skills
- Professionalism skills
- Interaction skills
- Information acquisition skills
- Organizational skills

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT 'learning outcomes' within these core competencies (i.e., ‘By the completion of food science program, the student should’):
• Understand the principles behind analytical techniques associated with food.
• Understand the chemistry underlying the properties and reactions of various food components.
• Be able to select the appropriate analytical technique when presented with a practical problem.
• Demonstrate practical proficiency in a food analysis laboratory.
• Be able to use the laboratory techniques common to basic and applied food chemistry.
• Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
• Know how to use computers to solve food science problems.
• Be aware of current topics of importance to the food industry.
• Demonstrate the use of oral and written communication skills.
• Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.
• Apply critical thinking skills to new situations.
• Work effectively with others.
• Independently research scientific and nonscientific information.
• Competently use library resources.
• Manage time effectively.
• Facilitate group projects.
• Handle multiple tasks and pressures.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

Tools used to assess learning outcomes (% total mark): Level of assessment (Bloom’s taxonomy)
Four in-class examinations through-out the academic year (90%) I-V
Laboratory notebook and performance (10%) II-V

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)
Average mark (out of 100): 39-51
Minimum: 11-19
Maximum: 77-86
% failure at first sitting: 16-52%

This module has been noted by students as being difficult as it involves developing problem solving skills involving calculations associated with Food Analysis. Many students find this numerical approach of this module difficult while others have no problem in this respect. These numeracy skills and problem solving skills are of key importance in their education as Food Scientists. In interviews of final year students many remark that the laboratory skills and numeracy and problem solving skills
they developed while taking this module equipped them well for some of the challenges they encountered while on their Work Placement. They also noted that this module provided them with the key skills they needed to successfully undertake the final year research projects. Students learn by lectures, laboratory sessions and tutorials. Problem/solution sets are also provided.
**FS2002 Introductory Food Chemistry: Food Constituents**

**Objective of module:** To introduce students to the fundamentals of the structural chemistry of food constituents

**Brief overview of modules content:** Structural chemistry of proteins, lipids and carbohydrates

**A. Specific learning outcomes, including how the course addresses the core competencies.**

1. Describe the role of carbohydrates,
2. proteins and lipids as the principal constituents of the human diet, and give their approximate content in common foods and beverages
3. Outline the principles, advantages and disadvantages of common methods for quantitative determination of proteins. Draw the structures of the amino acid as subunits of proteins, outline their properties and reactions
4. Describe the pH-dependent changes to amino acids and peptides and the principal factors that affect the solubility of proteins in water
5. Describe the primary, secondary and tertiary structures of proteins, giving examples where appropriate; define protein denaturation; describe the biological, physical and chemical changes that occur on denaturation, and the principal agents that cause denaturation
6. Define the term "lipid" and list the main categories of lipid molecules in food systems; outline the systems of nomenclature applied to fatty acids; describe and draw the structures of the most commonly-occurring fatty acids in foods, and outline their key physical and chemical properties, including the principal factors that influence their melting behaviour
7. Distinguish between monoglycerides, diglycerides and triglycerides and draw their structures; describe the key distinguishing features and properties of polar lipids and draw their structures, indicating hydrophilic and hydrophobic regions
8. Outline the key chemical properties of carotenoids and sterols, draw their general structure and describe their significance in foods
9. Describe the structures, laboratory synthesis and principal chemical reactions of monosaccharides, including interconversion between open chain and ring forms and formation of glycosidic bonds
10. Outline the structures, sources and properties of the main polysaccharides used in the food industry, and the structures of disaccharides and oligosaccharides of importance in nature and in the human diet.

**How the course addresses the core competencies:**
This module (course) addresses the following core competency:

**Food Chemistry and Analysis**
It cross-connects to the following stated content areas within this competency:

- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients.
- Chemistry of changes occurring during processing, storage and utilization

Our stated module learning outcomes above align closely with the following stated IFT ‘learning outcomes’ within this core competency (i.e., ‘By the completion of food science program, the student should’):

- Understand the chemistry underlying the properties and reactions of various food components.
- Understand the principles behind analytical techniques associated with food.
B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

Tools used to assess learning outcomes (% total mark): Level of assessment (Bloom’s taxonomy)
End of year written 1.5 h examination (100%) I-II

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)
Average mark (out of 100): 43-63
Minimum: 10-42
Maximum: 75-91
% failure at first sitting: 0-38%

This course is one of the main foundations of food chemistry in our programme. FS2002 covers the chemistry of amino acids, proteins, lipids and carbohydrates. Students find this course challenging. Material is made available to students through the University’s e-learning portal, “Blackboard” and through hard copy manuals.
**FS2003 Introductory Food Chemistry - Selected Topics in Physical Chemistry**

**Objective of module:** To introduce students to selected topics in physical chemistry of relevance to the understanding of the science and technology of food systems.


**A. Specific learning outcomes, including how the course addresses the core competencies.**

1. Discuss molecular behaviour and factors that influence this behaviour
2. Apply knowledge of thermodynamics, including the concepts of internal energy, heat, work, enthalpy, entropy, and free (Gibbs) energy, to food systems and do quantitative calculations on thermodynamics
3. Describe the states of matter; describe the thermodynamic determinants of these states and factors influencing transition from one state to another and show how these factors are exploited in food systems
4. Describe the colligative properties of solutions; do quantitative calculations on the colligative properties of solutions; relate colligative properties to food systems/processing
5. Explain batch and fractional distillation; discuss steam distillation and distillation of non-ideal mixtures and do quantitative calculations on batch distillation processes
6. Describe the basic principles of chemical kinetics; rate law, rate constant, reaction order and temperature effects; do quantitative calculations on chemical kinetics and relate these to food labeling and shelf life
7. Discuss the phenomena of surface/interfacial tension/pressure and their measurement; discuss surface absorption of solutes and relate this to food emulsion and foam formation and stabilization; do quantitative calculations on surface/interfacial tension/pressure
8. Carry out appropriate laboratory experiments, make accurate observations and write appropriate reports.

**How the course addresses the core competencies:**

This module (course) addresses the following core competencies:

**Food Chemistry and Analysis**

It cross-connects to the following content areas within these competencies:

- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Chemistry of changes occurring during processing, storage and utilization

**Food Safety and Microbiology**

It cross-connects to the following content areas within these competencies:

- Influence of the food system on the growth and survival of microorganisms

**Food Processing and Engineering**

It cross-connects to the following content areas within these competencies:

- Engineering principles including mass and energy balances, thermodynamics, fluid flow, and heat and mass transfer
- Principles of food processing techniques, such as freeze drying, high pressure, aseptic processing, extrusion, etc.
Applied Food Science

It cross-connects to the following content areas within these competencies:

- Principles of food preservation including low and high temperatures, water activity, etc.
- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Quality assurance

Success Skills.

It cross-connects to the following content areas within these competencies:

- Communication skills (i.e., oral and written communication, listening, interviewing, etc.)
- Critical thinking/problem solving skills (i.e., creativity, common sense, resourcefulness, scientific reasoning, analytical thinking, etc.)

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., ‘By the completion of food science program, the student should’):

- Understand the chemistry underlying the properties and reactions of various food components
- Have sufficient knowledge of food chemistry to control reactions in foods.
- Understand the major chemical reactions that limit shelf life of foods.
- 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.
- Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage.
- Understand the principles that make a food product safe for consumption
- Understand the transport processes and unit operations in food processing as demonstrated both conceptually and in practical laboratory settings
- Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality.
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Be able to apply the principles of food science to control and assure the quality of food products
- Demonstrate the use of oral and written communication skills. This includes such skills as writing technical reports, letters and memos; communicating technical information to a non-technical audience; and making formal and informal presentations
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations
- Apply critical thinking skills to new situations.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

<table>
<thead>
<tr>
<th>Tools used to assess learning outcomes (% total mark)</th>
<th>Level of assessment (Bloom’s taxonomy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>End of year written 1.5 h examination (80%)</td>
<td>I-IV</td>
</tr>
<tr>
<td>Laboratory notebook and performance (5%)</td>
<td>I-III</td>
</tr>
<tr>
<td>Three in-class tests (30 mins each) (15%)</td>
<td>I-IV</td>
</tr>
</tbody>
</table>
C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)

**Average mark (out of 100):** 49-57  
**Minimum:**  11-23  
**Maximum:**  74-92  
**% failure at first sitting:** 5-28%

This module has been noted by students as difficult as it involves understanding basic physical chemistry concepts, developing numerical equations related to these concepts and applying these concepts and equations to aspects of basic food science and food processing and preservation. Some students find the numerical approach of the module rather difficult while others have no problem in this respect. Students learn by lectures/laboratory sessions and problem/solution sets provided. All module lecture and laboratory notes and problem/solution sets are made available on the University e-learning portal, “Blackboard”.
FS2004 Topics in Food Quality and Legislation A

Objective of module: To provide students with an overview of key aspects of quality systems, statistical quality control and legislation in the food industry.

Brief overview of modules content: Good laboratory practice (GLP). Statistical quality control including use of control charts and sampling procedures. Quality systems standards including ISO. Auditing. Good Manufacturing Practice and HACCP. Principles of cleaning and sterilisation. Food legislation in Ireland and EU. Codex Alimentarius.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Explain the objectives of food legislation and the approach used in Ireland to the enactment and enforcement of food legislation.
2. Outline the approach in the European Union to the regulation of the food sector and describe the role of the Codex Alimentarius Commission in harmonising non-tariff barriers to food trade worldwide.
3. Explain the meaning of terms relevant to food analysis data: accuracy, precision, repeatability, reproducibility, error, bias, specificity, sensitivity, limit of detection, limit of quantitation.
4. Describe the background, the key principles including calibration and use of reference materials, and the accreditation process for Good Laboratory Practice (GLP).
5. Outline the benefits, the use and implementation of Control Charts in a manufacturing facility including indications for action when using the charts and outline the key principles of random, variable and attribute sampling plans.
6. Explain the meaning of terms relevant to food quality and safety: hazards, contamination, adulteration, mix-up, auditing, quality systems, generally regarded as safe (GRAS).
7. Describe the background, the practice distinctions and the ten substantive areas of Good Manufacturing Practice (GMP).
8. Outline the basic elements of hazard analysis critical control points (HACCP) and the general approach to implementing a HACCP plan within a food company.
9. Describe the background, the various systems used and the practical implementation of the International Standards Organisation (ISO) quality system within the food manufacturing industry.

How the course addresses the core competencies:
This module (course) addresses the following core competencies:

Food Chemistry and Analysis
It cross-connects to the following content areas within this competency:

- Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients.

Applied Food Science
It cross-connects to the following content areas within this competency:

- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Statistical skills
- Quality assurance
- Food laws and regulations
- Current issues in food science
Success Skills
It cross-connects to the following content areas within this competency:
- Critical thinking/problem solving skills
- Information acquisition skills
- Organizational skills

Our stated module learning outcomes above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., ‘By the completion of food science program, the student should’)

- Understand the principles behind analytical techniques associated with food.
- Be able to select the appropriate analytical technique when presented with a practical problem.
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Be able to apply statistical principles to food science applications.
- Be able to apply the principles of food science to control and assure the quality of food products.
- Be aware of current topics of importance to the food industry.
- Understand government regulations required for the manufacture and sale of food products
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.
- Apply critical thinking skills to new situations.
- Independently research scientific and nonscientific information.
- Competently use library resources.
- Manage time effectively.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

Tools used to assess learning outcomes (% total mark):  Level of assessment (Bloom’s taxonomy)
End of year written 1.5 h examination (80%)  II-V
Minor library project (20%)  IV,V

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)
Average mark (out of 100): 42-56
Minimum: 18-40
Maximum: 68-73
% failure at first sitting: 0-37%
This module is generally well received by students as it involves introducing them to a new topic area which pertains to food quality, food safety and legislation. Most will inform you that they do have to work at it, as due to the nature of the subject area, it can be quite challenging. A library project augments the lecture material and it is designed to teach students how to conduct research, using library facilities. This is the first real test in project research and write-up that the students have faced to this point in their third level education. Again, most students find the library project challenging at first, but mostly admit that on completion of the project that they have learned quite a lot from the exercise, many stating enormous satisfaction in having completed such a task.
FS3001 Work Placement

Objective of module: To provide an opportunity for students to gain relevant work experience in a commercial environment.

Brief overview of modules content: Students will be placed in an industrial or other relevant work environment for 24 weeks, and will be expected to make a significant contribution to a relevant project under the supervision of industrial and UCC personnel. Students are obliged to actively participate in the Work Placement Programme and to attend scheduled interviews. Students are required to prepare a final report on their placement, and make a presentation on their work.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Identify, relate and apply the content of academic courses to specific work practices and make a worthwhile contribution in the workplace
2. Differentiate between job roles in the workplace to aid career choice
3. Reflect on the experiential learning and personal development that takes place during placement and summarise in a Reflective log and Final Written Report
4. Display people related skills - communications, influencing, interpersonal, team working, listening and customer care
5. Display conceptual skills - researching, collecting and organising information, problem solving, planning and organising, learning to learn, innovation and creativity, systems thinking and self-reliance
6. Demonstrate professional behaviour and accept the need for confidentiality and ethical practice in the workplace
7. Show commercial awareness through knowledge of basic business operations
8. Where appropriate, operate the required range of equipment and perform the required role in an efficient and safe way.

How the course addresses the core competencies:

This module (course) addresses the following core competencies:

Applied Food Science

It cross-connects to the following content areas within this competency:

- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Computer skills
- Quality assurance
- Analytical and affective methods of assessing sensory properties of food utilizing statistical methods
- Current issues in food science
- Food laws and regulations

Success skills

- It cross-connects to the following content areas within this competency:
- Communication skills
- Critical thinking/problem solving skills
- Professionalism skills
- Interaction skills
- Information acquisition skills
- Organizational skills
Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT 'learning outcomes' within these core competencies (i.e., 'By the completion of food science program, the student should'):  
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.  
- Know how to use computers to solve food science problems.  
- Be able to apply the principles of food science to control and assure the quality of food products.  
- Understand the basic principles of sensory analysis.  
- Be aware of current topics of importance to the food industry.  
- Understand government regulations required for the manufacture and sale of food products.  
- Demonstrate the use of oral and written communication skills.  
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.  
- Apply critical thinking skills to new situations.  
- Commit to the highest standards of professional integrity and ethical values.  
- Work and/or interact with individuals from diverse cultures.  
- Explain the skills necessary to continually educate oneself.  
- Work effectively with others.  
- Provide leadership in a variety of situations.  
- Deal with individual and/or group conflict.  
- Independently research scientific and nonscientific information.  
- Competently use library resources.  
- Manage time effectively.  
- Facilitate group projects.  
- Handle multiple tasks and pressures.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

<table>
<thead>
<tr>
<th>Tools used to assess learning outcomes*</th>
<th>Level of assessment (Bloom’s taxonomy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student's weekly learning log</td>
<td>II</td>
</tr>
<tr>
<td>Academic mentor's visit†</td>
<td>II</td>
</tr>
<tr>
<td>Student's final written report</td>
<td>II-III</td>
</tr>
<tr>
<td>Employer's assessment report†</td>
<td>III-VI</td>
</tr>
<tr>
<td>Oral presentation</td>
<td>II</td>
</tr>
</tbody>
</table>

*No mark assigned, 'pass and progress' or 'fail' judgment  
†Please see Appendix IV for examples

C. Brief summary of assessment results to date

Students find this module of immense benefit to them in terms of their training as Food Scientists. It gives them an opportunity to apply their knowledge of Food Science to practical real world situations. It also provides them with an opportunity to develop success skills, as listed above, in a real world industrial environment. It helps them to mature as young adults, aids them in their career choice and enhances their employability. The University has committed considerable resources to this module providing the School with a full-time Work Placement Officer and associated administrative staff who liaise with national and international food related companies who provide placement for students in
the programme. Companies recruit students for Work Placement through an interview process. Workshops on the preparation of Curriculum Vitae and the development of interview skills are organised for the students prior to commencement of this process. While students are on placement they are supported by an industrial mentor from the Company and by an academic mentor who is an academic staff member. The student, academic mentor and industrial mentor are in constant communication with one another during placement and this partnership is a key element which ensures the success our placement programme. Feedback from employers has been extremely positive.
FS3002 Chemistry of Food Proteins

Objective of module: To discuss comprehensively the chemical and physical properties of food proteins.

Brief overview of modules content: Chemistry of food protein systems (milk, meat, fish, eggs, cereals, legumes, unconventional protein sources). Preparation and characterisation of food proteins. Protein determination in foods. Introduction to the properties of enzymes and enzyme systems. A set of practicals will support lecture material.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. State the composition of milks of various species; describe the chemistry of the protein system in milk and the salt (mineral) system in milk and its association with the protein system; contrast human and bovine milks; describe the mechanisms of acid and rennet induced coagulation of milk proteins; discuss the heat stability of milk and the thermal denaturation of milk proteins and its consequences
2. State the composition of the avian egg and its fractions; diagrammatically illustrate the structure of the avian egg; discuss indices of ageing of an egg; describe specific biochemical properties of the individual egg white proteins
3. Outline the structure, function and location of proteins in skeletal muscle and the main events involved in muscle contraction of post-mortem glycolysis
4. Discuss the properties of cereal proteins
5. Describe the main factors which affect enzyme activity and explain what it meant by indigenous, exogenous and endogenous enzymes, giving examples of each
6. Specify raw materials from which dry food protein enriched ingredients are recovered and detail some general aspects considered during their recovery; discuss specifications and international standards for dry food protein enriched ingredients
7. Describe how the physico-chemical properties of milk constituents are exploited in industrial scale processes used to recover dry milk protein enriched ingredients, including fractionated milk protein enriched ingredients, milk protein hydrolysates and bioactive milk peptides
8. Describe how the physico-chemical properties of eggs, wheat, soya bean and legumes are exploited in industrial scale processes used to recover dry egg, wheat, soya and legume protein-enriched ingredients
9. Discuss methods of protein recovery/isolation and characterisation on a laboratory scale and present some case studies on protein recovery/isolation.

How the course addresses the core competencies:
This module (course) addresses the following core competencies:

Food Chemistry and Analysis
It cross-connects to the following content areas within this competency:
- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Chemistry of changes occurring during processing, storage and utilization
- Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients

Food Processing and Engineering
It cross-connects to the following content areas within this competency:
- Characteristics of raw food material
- Engineering principles including mass and energy balances, thermodynamics, fluid flow, and heat and mass transfer
- Principles of food processing techniques, such as freeze drying, high pressure, aseptic processing, extrusion, etc.

**Applied Food Science**

It cross-connects to the following content areas within this competency:

- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Quality assurance
- Current issues in food science
- Food laws and regulations

**Success skills**

It cross-connects to the following content areas within this competency:

- Communication skills
- Critical thinking/problem solving skills
- Professionalism skills
- Interaction skills
- Information acquisition skills
- Organizational skills

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT 'learning outcomes' within these core competencies (i.e., 'By the completion of food science program, the student should'):

- Understand the chemistry underlying the properties and reactions of various food components
- Have sufficient knowledge of food chemistry to control reactions in foods.
- Be able to use the laboratory techniques common to basic and applied food chemistry.
- Understand the principles behind analytical techniques associated with food.
- Be able to select the appropriate analytical technique when presented with a practical problem.
- Demonstrate practical proficiency in a food analysis laboratory
- Understand the source and variability of raw food material and their impact on food processing operations.
- Understand the unit operations required to produce a given food product.
- Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality.
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Be able to apply the principles of food science to control and assure the quality of food products
- Be aware of current topics of importance to the food industry.
- Understand government regulations required for the manufacture and sale of food products.
- Demonstrate the use of oral and written communication skills.
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations
- Apply critical thinking skills to new situations
- Commit to the highest standards of professional integrity and ethical values.
- Work and/or interact with individuals from diverse cultures.
- Work effectively with others.
- Independently research scientific and nonscientific information.
- Competently use library resources.
- Manage time effectively
- Facilitate group projects.
- Handle multiple tasks and pressures

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

\[
\begin{align*}
\text{Tools used to assess learning outcomes (% total mark):} & \quad \text{Level of assessment (Bloom’s taxonomy)} \\
\text{End of year written 1.5 h examination (80%)} & \quad \text{II-III} \\
\text{Laboratory notebook and performance (20%)} & \quad \text{II-V}
\end{align*}
\]

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

\[
\begin{align*}
\text{Range over three years (2008-2011)} \\
\text{Average mark (out of 100):} & \quad 45-52 \\
\text{Minimum:} & \quad 13-31 \\
\text{Maximum:} & \quad 71-83 \\
\text{% failure at first sitting:} & \quad 11-20%
\end{align*}
\]

This module has been noted by most students as not overly difficult as it involves developing their knowledge on the protein systems in food groups with which they are familiar and relating this knowledge to concepts of processing and preservation of these food groups and ingredients derived from them. Students learn by lectures and laboratory sessions. All module lecture and laboratory notes are made available on the University e-learning portal, “Blackboard”.

FS3003 Chemistry and Technology of Oils and Fats

Objective of module: To provide a detailed overview of key aspects of the chemistry and technology of food fats


A. Specific learning outcomes, including how the course addresses the core competencies.

1. Describe the process for manufacture of butter and low- and full-fat dairy-based spreads
2. Explain how changing process variables and ingredients used to influence the characteristics of the above products
3. Explain the importance of flow-behaviour of fats and oils to their use as spreads and food ingredients
4. Determine crystalline forms of fats and oils and use thermal processes to achieve desired and stable crystalline forms of lipids including cocoa butter in chocolate
5. Explain typical industrial processes used to recover and refine edible fats and oils
6. Describe processes to extract fats and oils from plant and animal sources and manipulate properties of fats and oils using fractionation, hydrogenation and interesterification
7. Outline the chemical reactions involved in the oxidative deterioration of food lipids, the key factors that influence the rate of these chemical reactions and how lipid oxidation may be measured in food products
8. Describe the lipid systems of milk, eggs, meat, fish and the major oilseeds
9. Carry out laboratory procedures relevant to the academic content of the module.

How the course addresses the core competencies:

This module (course) addresses the following core competencies:

Food Chemistry and Analysis
It cross-connects to the following content areas within this competency:

- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Chemistry of changes occurring during processing, storage and utilization
- Principles, methods and techniques of qualitative and quantitative physical, chemical and biological analyses of food and food ingredients

Food Processing and Engineering
It cross-connects to the following content areas within this competency:

- Characteristics of raw food material
- Principles of food preservation
- Engineering principles
- Principles of food processing techniques

Applied Food Science
It cross-connects to the following content areas within this competency:

- Integration and application of food science principles (food chemistry, microbiology, engineering/processing)
- Quality assurance
- Current issues in food science
- Food laws and regulations
Success Skills
It cross-connects to the following content areas within this competency:

- Communication skills
- Critical thinking/problem solving skills

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., ‘By the completion of food science program, the student should’):

- Understand the chemistry underlying the properties and reactions of various food components
- Have sufficient knowledge of food chemistry to control reactions in foods.
- Understand the major chemical reactions that limit shelf life of foods
- Be able to use the laboratory techniques common to basic and applied food chemistry.
- Understand the principles behind analytical techniques associated with foods
- Be able to select appropriate analytical technique when presented with a practical problem
- Demonstrate practical proficiency in food analysis laboratory
- Understand the source and variability of raw food material and their impact on food processing operations
- Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage
- Understand the principles that make a food product safe for consumption
- Understand the transport processes and unit operations in food processing as demonstrated both conceptually and in practical laboratory settings
- Be able to use mass and energy balances for a given food process
- Understand the unit operations required to produce a given food product
- Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality
- Be able to apply and incorporate the principles of Food Science in practical, real-world situations and problems
- Be able to apply the principles of Food Science to control and assure the quality of food products
- Be aware of current topics of importance to the food industry
- Understand government regulations required for the manufacture and sale of food products
- Demonstrate the use of oral and written communication skills
- Apply critical thinking skills to new situations
- Work and/or interact with individuals from diverse cultures
- Work effectively with others
- Independently research scientific and non-scientific information
- Competently use library resources
- Manage time effectively

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

Tools used to assess learning outcomes (% total mark): Level of assessment (Bloom’s taxonomy)
End of year written 1.5 h examination (90%) II-IV
Laboratory notebook, performance (10%) II-IV
C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3 years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)
Average mark (out of 100): 46-58
Minimum: 22-38
Maximum: 64-81
% failure at first sitting: 7-19%

This module is generally well received by students as it involves developing their knowledge of food lipids which were introduced in the 2nd year of the programme in module FS2002. The practical and laboratory sessions augment the lecture material in both the food chemistry and processing aspects of the module – students enjoy these sessions, in particular practical sessions such as butter manufacture. All module lecture and laboratory notes are made available to students in hard-copy. This module is an example of an opportunity to combine both fundamental and applied aspects of food science, ranging from chemistry of lipids to manufacture of butter and spreads, and thus allows students to see the relationship between food constituents and processing strategies in an integrated and direct way.
FS3004 Sensory Analysis, Flavour and Colour

Objective of module: To provide a comprehensive overview of the interaction between food flavour, colour and sensory perception.

Brief overview of modules content: Colour pigments in foods; artificial colours; measurement of colour using instruments; colour perception. Non-volatile and volatile flavour composition of foods; measurement of flavour using instruments; flavour perception. Rheology, structure and texture perception. Interactions between colour, flavour and texture.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Define sensory analysis as the scientific measurement of the attributes of a product perceived by the senses (sight, sound, smell, taste touch); discuss the problems associated with informal sensory sessions and explain why formalized sensory methodology should be used.

2. Explain how we use our senses to assess sensory attributes; describe how, and in what order, appearance, odour/aroma/fragrance (orthonasal), consistency/texture and flavour (retro-nasal aroma and taste) attributes are perceived; describe the taste system and the olfactory systems in detail; recognise the inherent variability in human perception and judgment, resulting from differences in sensitivity between people.

3. Distinguish between the three main areas of sensory methodology (discrimination tests; descriptive analysis; preference or hedonics tests); describe procedures used in design of sensory experiments and in collection and analysis of sensory data; apply principles of good practice when conducting laboratory experiments for the sensory evaluation of foods.

4. Describe how sensory methods are used to (i) compare competitive products, (ii) interpret consumer-directed feedback and guide new product development, (iii) assure quality, and (iv) track changes in appearance, flavour and texture of foods over their shelf life.

5. Use magnitude estimation to obtain quantitative correlations between objective and perceived intensities of sensory stimuli, and describe how it has been applied in relating the rheology of thickened and gelled samples to perceived texture and flavour/taste release.

6. Describe in detail the CIE, Hunter and Munsell colour measurement systems; draw a line diagram of a tristimulus colorimeter and label its component parts.

7. Describe the chemical properties, stability and changes that occur during processing of chlorophyll, myoglobin, anthocyanins, flavones, flavonols, betalaines, carotenoids and apocarotenoid pigments and cochineal; discuss the chemistry and limitations of artificial food colourants.

8. Describe the principal chemical steps in caramelization, enzymatic and non-enzymatic (Maillard) browning and be able to apply this knowledge to the control of browning reactions in foods.

How the course addresses the core competencies:
This module (course) addresses the following core competency:

Applied Food Science
It cross-connects to the following content areas within this competency:

- Analytical and affective methods of assessing sensory properties of food utilizing statistical methods
- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Chemistry of changes occurring during processing, storage and utilization
• Characteristics of raw food material
• Analytical and affective methods of assessing sensory properties of food utilizing statistical methods

Our stated module learning outcomes above align closely with the following stated IFT ‘learning outcomes’ within this core competency (i.e., ‘By the completion of food science program, the student should’)

- Understand the basic principles of sensory analysis.
- Understand the chemistry underlying the properties and reactions of various food components
- Have sufficient knowledge of food chemistry to control reactions in foods.
- Understand the major chemical reactions that limit shelf life of foods.
- Understand the source and variability of raw food material and their impact on food processing operations.
- Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage.
- Be able to select the appropriate analytical technique when presented with a practical problem.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

Tools used to assess learning outcomes (% total mark): Level of assessment (Bloom’s taxonomy)

End of year written 1.5 h examination (90%) I-V
Laboratory notebook and performance (10%) II-V

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)
Average mark (out of 100): 46-54
Minimum: 20-26
Maximum: 71-73
% failure at first sitting: 3-31%

Students generally enjoy this module as its subject matter is quite varied and practical covering sensory analysis, food texture, colour measurement and the chemistry of pigments and browning reactions. Students learn through lectures and a small number of laboratory sessions. Course material is made available to students on the University’s e-learning portal, “Blackboard” and in hard copy.
FS3005 *Macromolecules and Rheology*

**Objective of module:** To study the role of macromolecules in creation and control of the physical structure and perceived texture of high-moisture foods

**Brief overview of modules content:** Structure and conformation of food polysaccharides. Hydrolysis products; saccharide analysis. Use of biopolymers as thickeners, stabilisers and gelling agents. Application of physical techniques to food biopolymers. Rheological characterisation of texture.

**A. Specific learning outcomes, including how the course addresses the core competencies.**

1. Describe and explain appropriate rheological terms and concepts.
2. Sketch the following: typical mechanical spectra for dilute solutions of biopolymers, entangled coils, gels, ‘weak gels’ and critically-crosslinked networks; creep-recovery curves for Hookean solids, Newtonian liquids and viscoelastic materials; typical compression curves for gels and spreads.
3. Describe and explain the concentration-dependence of ‘zero shear’ viscosity and shear-rate dependence of viscosity for solutions of entangled polysaccharide coils and the variation of intrinsic viscosity of polyelectrolytes with ionic strength.
4. Write the following equations: power law; Bingham, Herschel-Bulkeley and Casson; Einstein and Mark-Houwink; Cross equation and simplified form applicable to solutions of entangled polysaccharide coils.
5. Describe the structure, sources, production and food applications of a range of biopolymers and relate the ordered structure of each biopolymer chain to primary sequence and geometry of residue linkages. Apply the Second Law of Thermodynamics to association of hydrophilic and hydrophobic sequences.
6. Describe and explain the gelatinisation, pasting, gelation and retrogradation of starch and the mechanism of gel formation by carrageenans, furcellaran, agars, agarose, gellan, alginates, pectins, gelatin, globular proteins, methylcellulose, HPMC and ‘synergistic’ mixtures of selected biopolymers.
7. Outline the biosynthesis of alginates, carrageenans and agars and the implications for practical applications in food.
8. Explain the principles of the following physical techniques and describe their applications to food macromolecules: X-ray fibre diffraction, optical rotation, circular dichroism, differential scanning calorimetry, NMR and light scattering.
9. Carry out laboratory procedures relevant to the academic content of the module.

*How the course addresses the core competencies:*

This module (course) addresses the following core competencies:

**Food Chemistry and Analysis**

It cross-connects to the following content areas within this competency:

- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Chemistry of changes occurring during processing, storage and utilization
- Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients.

**Food Processing and Engineering**

It cross-connects to the following content areas within this competency:

- Characteristics of raw food material
- Principles of food preservation including low and high temperatures, water activity, etc.
- Engineering principles including mass and energy balances, thermodynamics, fluid flow, and heat and mass transfer
- Principles of food processing techniques, such as freeze drying, high pressure, aseptic processing, extrusion, etc.

**Applied Food Science**
It cross-connects to the following content areas within this competency:
- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Quality assurance
- Current issues in food science

**Success Skills**
It cross-connects to the following content areas within this competency:
- Communication skills (i.e., oral and written communication, listening, interviewing, etc.)
- Critical thinking/problem solving skills (i.e., creativity, common sense, resourcefulness, scientific reasoning, analytical thinking, etc.)

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT 'learning outcomes' within these core competencies (i.e., 'By the completion of food science program, the student should'):
- Understand the chemistry underlying the properties and reactions of various food components
- Have sufficient knowledge of food chemistry to control reactions in foods.
- Understand the major chemical reactions that limit shelf life of foods
- Be able to use the laboratory techniques common to basic and applied food chemistry.
- Understand the principles behind analytical techniques associated with food.
- Be able to select the appropriate analytical technique when presented with a practical problem.
- Demonstrate practical proficiency in a food analysis laboratory
- Understand the source and variability of raw food material and their impact on food processing operations. Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage.
- Understand the principles that make a food product safe for consumption.
- Understand the transport processes and unit operations in food processing as demonstrated both conceptually and in practical laboratory settings.
- Understand the unit operations required to produce a given food product
- Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality.
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Be able to apply the principles of food science to control and assure the quality of food products.
- Be aware of current topics of importance to the food industry.
- Demonstrate the use of oral and written communication skills. This includes such skills as writing technical reports, letters and memos; communicating technical information to a nontechnical audience; and making formal and informal presentations.
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.
- Apply critical thinking skills to new situations.
B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

Tools used to assess learning outcomes (% total mark): Level of assessment (Bloom’s taxonomy)
End of year written 1.5 h examination (85%) II-V
Laboratory notebook and performance (15%) III-V

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)
Average mark (out of 100): 54-60
Minimum: 30-40
Maximum: 71-79
% failure at first sitting: 0-12.5%

This module has been noted by most students as not overly difficult; it involves some basic physical chemistry aspects related to understanding and describing concepts of food texture/flow which some students find difficult. The module then seeks to develop their knowledge on the macromolecular (mainly polysaccharide) systems in food groups with which they are familiar and relating this knowledge to concepts of processing and preservation of these food groups and recovering and utilization of ingredients derived from them to influence and control food texture/flow; the students relate well to these aspects of the module. Students learn by lectures and laboratory sessions. All module lecture and laboratory notes are made available on the University e-learning portal, “Blackboard”.
FS3006  Food Processing and Preservation

Objective of module: To provide an understanding of food processing and preservation methods and principles, food material characteristics and requirements, and shelf-life control and stabilisation

Brief overview of modules content: Principles of food stability, preservation and safety; Traditional food preservation (salting, smoking, fermentation); Food components and ingredients (role of composition and ingredients, mechanical separation of components, homogenisation and emulsification, membrane processes, ion exchange, distillation, stability control); Freezing of foods and frozen foods stability; Conventional, dielectric and microwave heating; Thermal preservation (pasteurisation, UHT processing, sterilisation); Thermal kinetics (chemical, microbial, time-temperature indicators); Food concentration and dehydration; Food extrusion; Irradiation of foods; Minimal processing principles and novel food processing.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Describe the principle of operation of key heat-exchange systems used for food processing
2. Explain factors which may lead food processors to select specific processes and equipment for individual food applications
3. Describe the reasoning behind the use of chemical preservatives in food systems and the types which are permitted legally for use in food products within the EU
4. Select appropriate processes and preservation methods for fresh foods and manufacture foods and food ingredients with enhanced shelf-life
5. Describe cold storage and freezing processes in industrial food manufacturing
6. Select appropriate methods and processes, including mechanical and membrane separation technologies, to separate food components based on their physical and chemical characteristics
7. Use various dehydration techniques depending on their suitability for liquid and solid food dehydration
8. Improve food safety using minimal processing methods
9. Use food irradiation as an alternative for thermal processing and understand the impact of irradiation doses to changes in food components.

How the course addresses the core competencies:
This module (course) addresses the following core competency:

Food Processing and Engineering
It cross-connects to the following content areas within this competency:

- Principles of food preservation including low and high temperatures, water activity, etc.
- Engineering principles including mass and energy balances, thermodynamics, fluid flow, and heat and mass transfer.
- Principles of food processing techniques, such as freeze drying, high pressure, aseptic processing, extrusion, etc.

Our stated module learning outcomes above align closely with the following stated IFT ‘learning outcomes’ within this core competency (i.e., ‘By the completion of food science program, the student should’):

- Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage.
- Understand the principles that make a food product safe for consumption.
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- Understand the transport processes and unit operations in food processing as demonstrated both conceptually and in practical laboratory settings.
- Understand the unit operations required to produce a given food product.
- Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

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<tr>
<th>Tools used to assess learning outcomes (% total mark):</th>
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<tbody>
<tr>
<td>End of year written 3 h examination (90%)</td>
<td>II-IV</td>
</tr>
<tr>
<td>Laboratory notebook and performance (10%)</td>
<td>III</td>
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</tbody>
</table>

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)

Average mark (out of 200): 91-102
Minimum: 11-55
Maximum: 134-148
% failure at first sitting: 8-25%

This module has been noted by students as difficult. It is a large module involving three lecturers. Students learn by lectures and laboratory sessions all the important aspects of food processing and preservation which they find useful in applications and work placement. Students in the past found the module manual difficult to follow. Accordingly, all material has now been made more user-friendly and is available as Powerpoint presentations.
FS3007 Dairy Product Technology

**Objective of module:** To provide students with a detailed understanding of the production, properties, stability and quality of liquid, powdered, fractionated and frozen dairy products.

**Brief overview of modules content:** Overview of milk and dairy products, primary milk production, milk quality and sources of compositional variability, implications of such variability for dairy product processing, stability and quality.; Technology used in the manufacture of and quality of liquid milk products, cream products, milk powder technology, milk powder products, casein and caseinates, whey processing, whey-based products, ice cream products and technology; Dairy product specifications and functionality; Introduction to physicochemical and functional properties of dairy ingredients and products from the viewpoint of their applications in various food systems; Introduction to troubleshooting of processing and product quality issues in the dairy industry coupled with overview of analytical approaches of use in such troubleshooting initiatives.

**A. Specific learning outcomes, including how the course addresses the core competencies.**

1. Link the quality of dairy products to the quality of raw milk used in their production
2. Explain the factors which influence the suitability of farm milk in Ireland for manufacture of dairy products
3. Use commercial ingredients to produce dairy desserts including ice cream and explain functions of various ingredients in their formulation
4. Explain principles of industrial ice cream manufacturing processes and manipulation of ice formation, crystal size and ice recrystallization
5. Use state diagrams to explain stability and the kinetics of quality changes in frozen desserts
6. Describe the principal stages in the manufacture and equipment used for the production of pasteurized liquid milk, cream, UHT milk, extended shelf life milk, whey powders, lactose, whey protein concentrate, whey protein isolate, skim milk powder, whole milk powder, acid, rennet and lactic caseins, sodium caseinate and evaporated and condensed milks
7. Explain the chemical and physical changes which occur during the production of these products
8. Describe the principal quality attributes, shelf life stability issues and defects of these products.
9. Understand and apply practical solutions in the troubleshooting of processing and product quality issues in the manufacture of a variety of dairy products (as outlined in Point 6 above).

**How the course addresses the core competencies:**
This module (course) addresses the following core competency:

**Food Processing and Engineering**
It cross-connects to the following content areas within this competency:
- Characteristics of raw food material
- Principles of food preservation including low and high temperatures, water activity etc
- Engineering principles including mass and energy balances, thermodynamics, fluid flow and heat and mass transfer
- Principles of food processing techniques, such as freeze drying, high pressure, aseptic processing, extrusion etc.

Our stated module learning outcomes above align closely with the following stated IFT ‘learning outcomes’ within this core competency (i.e., ‘By the completion of food science program, the student should’).
• Understand the source and variability of raw food material and their impact on food processing operations
• Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage
• Understand the transport processes and unit operations in food processing as demonstrated both conceptually and in practical laboratory settings
• Understand the unit operations required to produce a given food product
• Be able to use the mass and energy balances for a given food process
• Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

Tools used to assess learning outcomes (% total mark): Level of assessment (Bloom’s taxonomy)
End of year written 1.5 h examination (80%) II-IV
Laboratory notebook and performance (20%) III-V

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)
Average mark (out of 100): 50-56
Minimum: 13-41
Maximum: 72-77
% failure at first sitting: 7-19%

The students have indicated good satisfaction with the quality and clarity of material presented and use of practical examples in this module. The module needs to be updated slightly to incorporate material on new dairy ingredients and products (e.g., milk protein concentrates, ideal whey and phosphocasein). Students have provided very good feedback on the module in relation to its relevance to their undergraduate work placement programme – they find it very useful, relevant and practical. All lecture information is provided to students electronically prior to lectures and great use is made of practical examples and information to make the lecture material tangible and relevant.
FS3008 Fundamentals of Food Packaging

Objective of module: To provide a thorough grounding in the fundamentals of food packaging.

Brief overview of modules content: Introduction to food packaging, fundamentals of food packaging, packaging development, graphic design and printing of food packaging materials, manufacture and use of glass, metals, paperboard, corrugated paperboard, plastics and laminates in the food industry, closure systems, use of adhesives, MAP, CAP and vacuum packaging of foods, food packaging lines, warehousing-transport-distribution of packaged foods, package labelling, drafting of packaging specification sheets, QA/QC testing of packaging materials, legal requirements for food packaging, food packaging waste.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Outline the primary, secondary and tertiary role of packaging in the food industry
2. Describe the information streams used to design packaging for food markets and the rules used in the development of the final food pack composition
3. Describe the composition, manufacture, properties and uses of food packaging materials
4. Explain the reasoning behind laminate manufacture, the processes used to manufacture laminates and commercial examples of laminates used with a wide range of food products
5. Describe the information required to be present on food packs as determined by EU legislation
6. Outline the basic elements required in order to print food pack graphics
7. Describe the use of seals and closure systems in commercial food pack forms
8. Explain the importance of food pack specification documents and describe in detail how a specification document would be drawn up.

How the course addresses the core competencies:
This module (course) addresses the following core competencies:

Food Chemistry and Analysis
It cross-connects to the following content areas within this competency:

- Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients.

Food Processing and Engineering
It cross-connects to the following content areas within this competency:

- Packaging materials and methods

Applied Food Science
It cross-connects to the following content areas within this competency:

- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Food laws and regulations

Success skills
It cross-connects to the following content areas within this competency:

- Communication
- Critical thinking/problem-solving skills
- Interaction skills
- Organization
Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT 'learning outcomes' within these core competencies (i.e., 'By the completion of food science program, the student should'):

- Understand the principles behind analytical techniques associated with food.
- Be able to select the appropriate analytical technique when presented with a practical problem.
- Demonstrate practical proficiency in a food analysis laboratory.
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Understand the properties and uses of various packaging materials.
- Understand government regulations required for the manufacture and sale of food products.
- Demonstrate the use of oral and written communication skills.
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.
- Apply critical thinking skills to new situations.
- Work effectively with others.
- Manage time effectively.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

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<tr>
<th>Tools used to assess learning outcomes (% total mark)</th>
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<tbody>
<tr>
<td>End of year written 1.5 h examination (90%)</td>
<td>II-V</td>
</tr>
<tr>
<td>Laboratory notebook and performance (10%)</td>
<td>III-V</td>
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</table>

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)

<table>
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<tr>
<th>Average mark (out of 100):</th>
<th>Minimum:</th>
<th>Maximum:</th>
<th>% failure at first sitting:</th>
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<tr>
<td>47-54</td>
<td>22-27</td>
<td>70-74</td>
<td>4-19%</td>
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</table>

This module is generally well received by students as it involves introducing students to a new scientific field and therefore helps to develop a new avenue of knowledge in the area of food packaging. They particularly like seeing packaged foods presented in class as model aids and can relate to the subject much better as a consequence. The practical and laboratory sessions augment the lecture material and students enjoy these sessions, in particular practical sessions pertaining to shelf-life studies. All module lecture and laboratory notes are made available to students in hard-copy.
FS4001 Research Project

Objective of module: To apply research techniques and integrate knowledge in identifying, describing, analysing and solving problems within the field of Food Science. To enhance communications skills.

Brief overview of modules content: Laboratory based research project on a Food Science topic under the supervision of a relevant staff member. Students will be expected to prepare a detailed report on their experimental work in conformance with guidelines that will be provided.

A. Specific learning outcomes, including how the course addresses the core competencies.
   1. Use experimental techniques relevant to their assigned project
   2. Design and plan informative investigations by these techniques
   3. Interpret the results obtained
   4. Produce a well-structured account of their experimental findings
   5. Write a critical review of published work relevant to the topic of their research.

How the course addresses the core competencies:
This module (course) addresses the following core competencies:

Food Chemistry and Analysis.
It cross-connects to the following content areas within this competency:
- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Chemistry of changes occurring during processing, storage and utilization
- Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients

Applied Food Science
It cross-connects to the following content areas within this competency:
- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Statistical skills
- Current issues in food science

Success Skills
It cross-connects to the following content areas within this competency:
- Communication skills
- Critical thinking/problem solving skills
- Professionalism skills
- Life-long learning skills
- Interaction skills
- Information acquisition skills
- Organizational skills

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., 'By the completion of food science program, the student should’):
- Understand the chemistry underlying the properties and reactions of various food components
- Have sufficient knowledge of food chemistry to control reactions in foods.
- Understand the major chemical reactions that limit shelf life of foods.
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Understand the chemistry underlying the properties and reactions of various food components.
- Be able to use the laboratory techniques common to basic and applied food chemistry.
- Understand the principles behind analytical techniques associated with food.
- Be able to select the appropriate analytical technique when presented with a practical problem.
- Demonstrate practical proficiency in a food analysis laboratory.
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Be able to apply statistical principles to food science applications.
- Be aware of current topics of importance to the food industry.
- Demonstrate the use of oral and written communication skills.
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.
- Apply critical thinking skills to new situations.
- Commit to the highest standards of professional integrity and ethical values.
- Work and/or interact with individuals from diverse cultures.
- Independently research scientific and nonscientific information.
- Competently use library resources.
- Manage time effectively.
- Handle multiple tasks and pressures.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

<table>
<thead>
<tr>
<th>Tools used to assess learning outcomes:</th>
<th>Level of assessment (Bloom’s taxonomy)</th>
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<tbody>
<tr>
<td>Laboratory Performance</td>
<td>III-VI</td>
</tr>
<tr>
<td>Report</td>
<td>III-VI</td>
</tr>
</tbody>
</table>

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)

| Average mark (out of 200): | 114-137 |
| Minimum:                  | 90-104  |
| Maximum:                  | 140-170 |
| % failure at first sitting: | 0%     |

While students find this module is very time consuming, they really enjoy it as it gives them an opportunity to apply and incorporate the principles of Food Science in a practical research.
environment. They have a great sense of achievement when they submit their final project report. Students carry out their projects in laboratories where they interact with postgraduate research students and research scientist and many students have noted that this interaction provides them with an excellent learning opportunity. During their projects students have access to a wide range of analytical and processing equipment and are supported by a project supervisor (an academic staff member) and the technical staff of the School. Students are provided with information regarding scientific writing and how to prepare a literature review and project report.
**FS4002 Team Product Development Project**

**Objective of module**: To provide students with scientific project experience applicable to all aspects of development of a food product or process; to enhance communication skills

**Brief overview of modules content**: Laboratory and processing hall-based research project on a relevant area of food science and technology under the supervision of an appropriate staff member. Students will prepare a detailed report on their experimental work and findings. Students will also attend a series of seminars and workshops designed to enhance communications skills.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Apply principles of new product development to the practical development of an innovative food product
2. Undertake a scientific research project in a systematic way in a small team
3. Produce an innovative food product at laboratory and pilot scale
4. Apply techniques such as chemical, physical, microbiological and sensory analysis, including shelf-life determination to a new food product, and develop a HACCP plan for this
5. Produce a comprehensive project report including a review of relevant literature
6. Understand how the fundamental rules of food packaging are applied in the development of new food products.

**How the course addresses the core competencies**:

This module (course) addresses the following core competencies:

**Food Chemistry and Analysis**
It cross-connects to the following content areas within this competency:
- Principles, methods, and techniques of qualitative and quantitative physical, chemical, and

**Applied Food Science**
It cross-connects to the following content areas within this competency:
- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Computer skills
- Statistical skills
- Biological analyses of food and food ingredients.
- Current issues in food science

**Success Skills**
It cross-connects to the following content areas within this competency:
- Communication skills (i.e., oral and written communication, listening, interviewing, etc.)
- Critical thinking/problem solving skills (i.e., creativity, common sense, resourcefulness, scientific reasoning, analytical thinking, etc.)
- Interaction skills (i.e., teamwork, mentoring, leadership, networking, interpersonal skills, etc.)
- Information acquisition skills (i.e., written and electronic searches, databases, Internet, etc.)
- Organizational skills (i.e., time management, project management, etc.)

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT 'learning outcomes' within these core competencies (i.e., 'By the completion of food science program, the student should'):
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
University College Cork’s Application to IFT Approval

- Know how to use computers to solve food science problems
- Be able to apply statistical principles to food science applications.
- Be able to select the appropriate analytical technique when presented with a practical problem.
- Demonstrate practical proficiency in a food analysis laboratory.
- Be aware of current topics of importance to the food industry.
- Demonstrate the use of oral and written communication skills. This includes such skills as writing technical reports, letters and memos; communicating technical information to a nontechnical audience; and making formal and informal presentations.
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.
- Apply critical thinking skills to new situations.
- Independently research scientific and nonscientific information.
- Competently use library resources.
- Work effectively with others.
- Provide leadership in a variety of situations.
- Deal with individual and/or group conflict.
- Manage time effectively.
- Facilitate group projects.
- Handle multiple tasks and pressures

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

*Tools used to assess learning outcomes: Level of assessment (Bloom’s taxonomy)*

- Review of literature: IV-VI
- Process and product development: III,V,VI
- Experimental work: III,V,VI
- Preparation of report: V,VI

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

*Range over three years (2008-2011)*

*Average mark (out of 200):* 121-124

*Minimum:* 80-110

*Maximum:* 137-140

*% failure at first sitting:* 0%

These projects are undertaken by small teams of 2-3 BSc Food Science students, who normally are paired with a similarly sized team of students from the BSc Food Business (now BSc Marketing and Entrepreneurship in the School of Food Business and Development, an Associate School to the School of Food and Nutritional Sciences). The students are responsible for initially preparing a list of ideas for new food products they may develop, which are then screened by Faculty in terms of
feasibility, degree of challenge, learning experience to be gained and novelty. Once a product to be developed has been identified, the team then work in parallel to develop the product, undertake market research, and prepare full business plans for commercial production. While the *BSc Food Science* students focus on the product and process development, they have a unique opportunity to learn some marketing and business principles from the business students.

The end-point of the projects is a public event, to which industry guests, teaching Faculty, university guests and students' families and friends are invited, and where the students show their final packaged product ready for tasting and feedback. In previous years, this has taken the form of a Showcase, with students preparing promotional stands and scaling up production of their product, while in 2011 a Dragon's Den (European equivalent of Shark Tank) format (See Appendix V), with a panel of local food entrepreneurs quizzing the students on their product, was successfully piloted. In all cases, a trophy (not linked to academic achievement or marking) is awarded to the team recommended by the judges as having undertaken the best product development work.

The module is thus a very important capstone course, where students put into practice a range of elements they have learned in many other modules (e.g., processing, ingredient function, packaging) in the specific context of developing new food products.

Feedback from students for these projects, and the climactic Showcase or similar event, has always been extremely positive. Although the projects are very time-consuming, the students recognise the value of the wide range of skills acquired, and the unique opportunity to synthesise a host of material learned in different modules in a single purpose. Students also frequently report great interest from employers in their projects and the skills acquired in this context.
FS4003 Advanced Analytical Methods

Objective of module: To teach advanced food analysis methods.

Brief overview of module content: This module will stress the theoretical aspects and practical applications of a number of analytical techniques used in the food industry and in food research laboratories. Students will have the opportunity to use a number of analytical techniques including HPLC, GC, electrophoresis, spectrophotometry, fluorimetry, differential scanning calorimetry, dynamic and static rheometry, viscometry, enzyme and immunochemical analyses.

A. Specific learning outcomes, including how the course addresses the core competencies.
   1. Outline the principles underlying the use of rheology, spectroscopy, differential scanning calorimetry, electrophoresis, chromatography and sensory science in food research.
   2. Describe the instrumentation involved in rheology, spectroscopy, differential scanning calorimetry, electrophoresis and chromatography and interpret data produced from these analytical units.

How the course addresses the core competencies:
This module (course) addresses the following core competencies:

Food Chemistry and Analysis
It cross-connects to the following content areas within this competency:
- Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients.
- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Chemistry of changes occurring during processing, storage and utilization
- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)

Applied Food Science
It cross-connects to the following content areas within this competency:
- Quality assurance
- Analytical and affective methods of assessing sensory properties of food utilizing statistical methods
- Current issues in food science

Success Skills
It cross-connects to the following content areas within this competency:
- Communication skills
- Critical thinking/problem solving skills
- Professionalism skills
- Life-long learning skills
- Interaction skills
- Information acquisition skills
- Organizational skills
Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT 'learning outcomes' within these core competencies (i.e., ‘By the completion of food science program, the student should’):

- Understand the principles behind analytical techniques associated with food.
- Understand the chemistry underlying the properties and reactions of various food components
- Be able to use the laboratory techniques common to basic and applied food chemistry
- Be able to select the appropriate analytical technique when presented with a practical problem
- Demonstrate practical proficiency in a food analysis laboratory.
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Be able to apply the principles of food science to control and assure the quality of food products
- Understand the basic principles of sensory analysis.
- Be aware of current topics of importance to the food industry.
- Demonstrate the use of oral and written communication skills.
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations
- Apply critical thinking skills to new situations
- Commit to the highest standards of professional integrity and ethical values.
- Work and/or interact with individuals from diverse cultures.
- Explain the skills necessary to continually educate oneself.
- Work effectively with others.
- Independently research scientific and nonscientific information.
- Competently use library resources.
- Manage time effectively
- Handle multiple tasks and pressures

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

*Tools used to assess learning outcomes (% total mark): Level of assessment (Bloom’s taxonomy)*

- End of year written 1.5 h examination (50%) II-V
- Laboratory notebook and performance (50%) II-III

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

*Range over three years (2008-2011)*

- Average mark (out of 100): 54-68
- Minimum: 19-52
- Maximum: 68-80
- % failure at first sitting: 0-11%
Student enjoy this module as it provides them with an opportunity to understand the principle underpinning a variety of advanced analytical methods and they get hands-on practical experience in using a variety of analytical equipment many of which they have read about previously in published research papers. Students learn by small group (8 students) discussions with academic staff and laboratory sessions and are provided with reading material regarding each laboratory session.
FS4006  Cereals and Related Beverages

Objective of module: To provide understanding of chemistry, microbiology and technology of cereals, cereal products as well as a wide range of beverages based on cereals.

Brief overview of modules content: Cereal and cereal products: structure, starch proteins, minor constituents, storage, milling, yeast leavened products, dough additives, biscuits, breakfast cereals, pasta, frozen doughs and bakery products. Beverages: Production of fermented and other beverages such as beer and distilled beverages based on cereals. Raw materials, equipment quality and legislation of these products/ processes will be discussed.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Outline the quality characteristics of barley varieties needed to produce good quality malt
2. Apply your knowledge of the basic principals of the malting to the design of malting processes, taking specific raw-material criteria into account
3. Apply your knowledge of the brewing process to work efficiently in the brewing industry
4. Outline the quality characteristics of wheat varieties needed for the development of various types of cereal products
5. Apply your knowledge of a wide range of cereal processing techniques to work efficiently in the food industry.
6. Apply your knowledge of the design of specialty cereal-based products such as part-baked products, frozen breads and gluten-free products to develop or design new products for the food industry.

How the course addresses the core competencies:
This module (course) addresses the following core competencies:

Food Safety and Microbiology
It cross-connects to the following content areas within this competency:
- Beneficial microorganisms in food systems
- Pathogenic and spoilage microorganisms in foods

Food Processing and Engineering
It cross-connects to the following content areas within this competency:
- Characteristics of raw food material
- Principles of food preservation including low and high temperatures, water activity, etc.
- Cleaning and sanitation
- Water and waste

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., ‘By the completion of food science program, the student should’):
- Understand the source and variability of raw food material and their impact on food processing operations.
- Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage.
- Understand the principles that make a food product safe for consumption.
- Understand the basic principles and practices of cleaning and sanitation in food processing operations.
- Understand the principles involving food preservation via fermentation processes.
- Identify the important pathogens and spoilage microorganisms in foods and the conditions under which they will grow.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

Tools used to assess learning outcomes (% total mark): Level of assessment (Bloom’s taxonomy)
End of year written 1.5 h examination (70%) III-V
Laboratory/practical examination (30%) II,III

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)
Average mark (out of 100): 58
Minimum: 20-43
Maximum: 72-75
% failure at first sitting: 0-7%

Students find the content of this module very interesting since it deals with products they can identify themselves with very easily. The students also greatly appreciate the practical part of the module which is carried out in the pilot-scale brewing, malting and cereal processing area; where they produce a wide range of products and analyze them with state of the art analytical equipment. At the end of the practical there is an examination, which focuses on the practical only, but the lectures also contribute to the understanding of material presented to them in practical sessions. The practical gives every student hands-on experience. The lecture material is presented to the students in colorful PowerPoint slides, which they can down load from Blackboard. Overall this module is very popular with the students, which leads to very few failures at the end of the year exam.
FS4010 Food Shelf Life Control

**Objective of module:** To provide understanding of physical chemistry concepts in the control of food properties and stability, and kinetics of chemical, enzymatic and microbial changes.


**A. Specific learning outcomes,** including how the course addresses the core competencies.

1. Identify foods as equilibrium and non-equilibrium systems and control driving forces affecting food stability and shelf life.
2. Use composition of foods to predict their physicochemical properties and changes in processing and storage.
3. Explain time-dependent characteristics of food materials.
4. Explain factors controlling rates of chemical, enzymatic, physical and microbial changes in foods.
5. Describe factors affecting diffusion and flow in foods and explain how food processes and composition can be used to maximize quality.
6. Use phase diagrams, state diagrams and shelf-life plots in food processing and design to predict and enhance food safety and stability.
7. Apply mathematical models to relate water content, temperature and other variables to predict reaction rates and microbial growth in foods.

**How the course addresses the core competencies:**
This module (course) addresses the following core competencies:

**Food Chemistry and Analysis**
It cross-connects to the following content areas within this competency:
- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Chemistry of changes occurring during processing, storage and utilization
- Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients

**Food Safety and Microbiology**
It cross-connects to the following content areas within this competency:
- Pathogenic and spoilage microorganisms in foods
- Influence of the food system on the growth and survival of microorganisms

**Food Processing and Engineering**
It cross-connects to the following content areas within this competency:
- Principles of food preservation including low and high temperatures, water activity, etc.

**Applied Food Science**
It cross-connects to the following content areas within this competency:
- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Quality assurance
Current issues in food science

Success Skills
It cross-connects to the following content areas within this competency:

- Critical thinking/problem solving skills (i.e., creativity, common sense, resourcefulness, scientific reasoning, analytical thinking, etc.)

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT 'learning outcomes' within these core competencies (i.e., 'By the completion of food science program, the student should'):

- Understand the chemistry underlying the properties and reactions of various food components.
- Have sufficient knowledge of food chemistry to control reactions in foods.
- Understand the major chemical reactions that limit shelf life of foods.
- Be able to select the appropriate analytical technique when presented with a practical problem.
- Identify the conditions under which the important pathogens are commonly inactivated, killed or made harmless in foods.
- 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.
- Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage.
- Understand the principles that make a food product safe for consumption.
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Be able to apply the principles of food science to control and assure the quality of food products.
- Be aware of current topics of importance to food science.
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

**Tools used to assess learning outcomes:**  
**Level of assessment (Bloom’s taxonomy)**

End of year written 1.5 h examination  
II-V

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:
Range over three years (2008-2011)

Average mark (out of 100): 55-67
Minimum: 40-41
Maximum: 73-86
% failure at first sitting: 0%

Students find the module content difficult as it presents physicochemical principles of food shelf-life control at an advance level. The module also requires critical thinking skills and application of knowledge. The connection of the physicochemical principles and food materials properties vs. basic foods, such as meat, bread and milk, is often not fully understood by students. The students often complain presentation of diagrams that explain relationships of rates and food composition. A library project was discontinued as students found that too demanding. The material has been renewed in line with student feedback and made easier to follow in the form of Powerpoint presentations that students may download.
FS4011 Advanced Food Packaging

Objective of module: To provide a more advanced programme of lectures relating to current, topical and expanding research interest areas within the field of food packaging science

Brief overview of modules content: Active food packaging; Advanced testing of packaging materials; Identification methods used for plastic food packaging materials; Shaping and manufacturing processes used for the production of moulded plastic food containers; Edible films and coatings used in the food packaging industry; Use of smart packaging by the food industry; Use of sensor technology within the food packaging industry; Consumer attitudes to food packaging materials; Packaging material residues in food products; Advanced commercial aspects of food packaging; Advanced food packaging systems used for all food categories.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Outline all food product categories and describe in detail how and why specific food packaging materials should be used to pack these products.
2. Describe the use of smart packaging technologies for use with food products.
3. Explain the differences between edible and biodegradable packaging materials and describe the types of packaging materials in existence today and their commercial uses.
4. Outline the commercial forms of printing technologies used and describe how these technologies are applied to produce the necessary graphics which appear on all retail food packs.
5. Describe the various engineering approaches used to manufacture plastics for use within the food industry.
6. Outline all of the considerations which need to be addressed when setting up a food production and packaging line.
7. Describe machinery and production processes used on the filling and packaging lines used for liquid products.
8. Describe machinery and production processes used on the filling and packaging lines used for solid products.

How the course addresses the core competencies:
This module (course) addresses the following core competencies:

Food Processing and Engineering
It cross-connects to the following content areas within this competency:

- Packaging materials and methods

Applied Food Science
It cross-connects to the following content areas within this competency:

- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Food laws and regulations

Success skills
It cross-connects to the following content areas within this competency:

- Communication
- Critical thinking/problem-solving skills
- Interaction skills
- Information acquisition skills
• Organization
• Professionalism skills

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., ‘By the completion of food science program, the student should’):

• Be able to select the appropriate analytical technique when presented with a practical problem
• Demonstrate practical proficiency in a food analysis laboratory.
• Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
• Understand the properties and uses of various packaging materials.
• Understand government regulations required for the manufacture and sale of food products.
• Demonstrate the use of oral and written communication skills.
• Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.
• Apply critical thinking skills to new situations.
• Work effectively with others
• Manage time effectively
• Independently research scientific and nonscientific information.
• Competently use library resources
• Work and/or interact with individuals from diverse cultures.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

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<tr>
<th>Tools used to assess learning outcomes:</th>
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</thead>
<tbody>
<tr>
<td>End of year written 1.5 h examination</td>
<td>II-VI</td>
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</tbody>
</table>

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)

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<th>Average mark (out of 100):</th>
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<tr>
<td>Minimum:</td>
<td>20-30</td>
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<tr>
<td>Maximum:</td>
<td>60-70</td>
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<tr>
<td>% failure at first sitting:</td>
<td>13-23%</td>
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This module builds on FS3008 Fundamentals of Food Packaging and students like the module as it allows them to see how cutting edge research and development is being undertaken by the packaging industry to deliver solutions to tomorrow’s potential problems pertaining to issues like food security, bio-terrorism, counterfeiting, energy shortages and environmental issues pertaining to sustainability. Again, they particularly like seeing new packaging materials or ideas for new packaging materials presented in class as model aids and can relate to the subject much better as a
consequence. There is no practical or laboratory sessions associated with this module and this was purposefully considered so as to lighten student workload in order to assist them in progressing with their final year projects.
FS4014  Food Product Development and Innovation

Objective of module: To provide an understanding of technological and scientific aspects of new product development (NPD) in the food sector, as well as the factors influencing food choice, the implications of this for the new food product development process, and methods to develop more market-oriented food products.

Brief overview of modules content: The scientific and technological principles underpinning NPD will be explained, including stages of the NPD process and activities, NPD success factors, new product design, food innovation case studies, market-oriented NPD methodologies, organisation for successful NPD, integration of market and sensory analysis, marketing of novel foods, food safety and shelf-life aspects of NPD and use of novel food ingredients and novel processing technologies. In parallel, students will learn about the various tools and methodologies utilised to evaluate consumer attitudes, preferences and market acceptance factors and the implications for NPD strategies. Factors that influence NPD success will be identified and innovation case studies will highlight best practice in terms of the integration of technological and marketing approaches to NPD. Topics addressed will include food choice models and new product trends.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Identify the key new product development (NPD) success factors across sectors worldwide;
2. Design an NPD process for a new food product and identify the different commercialisation strategies that food firms utilise in competitive markets;
3. Integrate disciplines such as sensory analysis, process design, ingredient selection and statistical analysis into a coherent strategy for the technological development of new food products;
4. Critically analyse the role of knowledge management and effective marketing strategies in new food product success.

How the course addresses the core competencies:
This module (course) addresses the following core competency:

Applied Food Science
It cross-connects to the following content areas within this competency:

- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Computer skills
- Current issues in food science

Our stated module learning outcomes above align closely with the following stated IFT learning outcomes within this core competency (i.e., ‘By the completion of food science program, the student should’)

- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Know how to use computers to solve food science problems.
- Be aware of current topics of importance to the food industry.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)
Tools used to assess learning outcomes (% total mark):  Level of assessment (Bloom’s taxonomy)
End of year written 1.5 h examination (90%)  II,III,V,VI
Powerpoint presentation (10%)  IV,VI

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)

Average mark (out of 100):  53-60
Minimum:  34-52
Maximum:  63-69
% failure at first sitting:  0-18%

The principal function of this module is to accompany the NDP team projects (FS4002) and is unique in that it is delivered 50:50 by an expert in food science and technology (Professor Alan Kelly) and an expert in food marketing (Dr Joe Bogue, of the School of Food Business and Development). This module is well received by students opting for FS4002, who appreciate the good use of case studies and examples in the module, and the fact that it is a key opportunity for them to get a combined technical and business approach to NPD in the same module. It also presents one of the few opportunities for the students to develop business skills and an understanding of marketing and consumer-related matters.

The module is effectively a capstone course, where students apply elements they have learned in many other modules (e.g., processing, ingredient function, packaging) and re-evaluate this knowledge specifically in the context of developing new food products.

The continuous assessment element of the module is also different to that encountered in many modules, consisting as it does of an assignment to reverse engineer a new food product on the Irish market (selected by the student but approved by the module lecturers) and make a Powerpoint presentation to the class on what is innovative about the product from a marketing and technological perspective. This assignment thus both applies the principles learned in the classroom in a very practical manner and develops communication and presentation skills. The module is currently being revised to increase the emphasis on personal effectiveness of NPD team members, strengthen the process development aspect of the module, and introduce more industry-sourced case studies.
FS4020 Dairy Science and Technology

Objective of module: To provide an understanding of chemistry, microbiology and technology of fermented dairy products and other topics related to dairy foods.

Brief overview of modules content: Discussion of lactose, heat and ethanol stability, acid and rennet coagulation of milk, syneresis, dairy starter cultures, bacteriophage and the technology of acid and rennet curd cheeses, yogurt, processed cheese, enzyme modified cheese, analogue cheese.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Describe the influence of processing steps and ingredient selection on the characteristics of processed cheese and yoghurt.
2. Describe in detail the process by which milk gels in the presence of acid and ethanol and outline what factors affect gel structure.
3. Explain in detail the rennet coagulation of milk and the factors which affect this process.
4. Describe the factors which affect the syneresis of rennet-induced milk gels.
5. Outline the principal steps usual in the preparation of milk for cheesemaking and describe the effects of each step on the finished product.
6. Describe the physicochemical and other changes which occur to cheesecurd on cheddaring and during the cooking-stretching step of the manufacture of pasta filata varieties.
7. Explain the functions of NaCl in cheese and the factors which affect salt uptake.
8. Explain the principal microbiological and biochemical events which occur in cheese during ripening.

How the course addresses the core competencies:
This module (course) addresses the following core competencies:

Food Chemistry and Analysis
It cross-connects to the following content areas within this competency:
- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Chemistry of changes occurring during processing, storage and utilization
- Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients

Food Safety and Microbiology
It cross-connects to the following content areas within this competency:
- Beneficial microorganisms in food systems
- Influence of the food system on the growth and survival of microorganisms

Food Processing and Engineering
It cross-connects to the following content areas within this competency:
- Principles of food preservation including low and high temperatures, water activity, etc.

Applied Food Science
It cross-connects to the following content areas within this competency:
- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT 'learning outcomes' within these core competencies (i.e., 'By the completion of food science program, the student should'):

- Understand the chemistry underlying the properties and reactions of various food components
- Have sufficient knowledge of food chemistry to control reactions in foods.
- Understand the major chemical reactions that limit shelf life of foods.
- Be able to use the laboratory techniques common to basic and applied food chemistry
- Demonstrate practical proficiency in a food analysis laboratory.
- Understand the principles involving food preservation via fermentation processes.
- 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.
- Demonstrate the use of oral and written communication skills. This includes such skills as writing technical reports, letters and memos; communicating technical information to a nontechnical audience; and making formal and informal presentations.
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

<table>
<thead>
<tr>
<th>Tools used to assess learning outcomes (% total mark)</th>
<th>Level of assessment (Bloom’s taxonomy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>End of year written 1.5 h examination (90%)</td>
<td>II-V</td>
</tr>
<tr>
<td>One laboratory report (2000-3000 word) (10%)</td>
<td>III-VI</td>
</tr>
</tbody>
</table>

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)

<table>
<thead>
<tr>
<th>Average mark (out of 100):</th>
<th>51-53</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum:</td>
<td>27-30</td>
</tr>
<tr>
<td>Maximum:</td>
<td>72-80</td>
</tr>
<tr>
<td>% failure at first sitting:</td>
<td>11-24%</td>
</tr>
</tbody>
</table>

Students enjoy this course as it is quite focused and practical, covering cheese and fermented milks. The course involves one day-long practical cheese-making session, and also the manufacture of yogurt and processed cheese in the pilot plant. In addition, students learn mainly though the medium of lectures and course material is made available on the University’s e-learning portal, “Blackboard” in addition to being given out in hard copy.
FS4021 Meat Science and Technology

Objective of module: To provide understanding of the chemistry, technology and microbiology of muscle-based foods


A. Specific learning outcomes, including how the course addresses the core competencies.

1. Outline the major pre- and post-slaughter factors which influence the quality of meat.
2. Describe the major steps involved in the slaughter of cattle, pigs and poultry.
3. Identify the major factors that influence the colour stability and water holding capacity of meat.
4. Describe the type, role and function of muscle-based proteins and their importance in the successful manufacture of processed products.
5. Identify the categories of ingredients used in the manufacture of processed meat products, describing in detail, the functional roles performed by these substances.
6. Explain the sequential steps involved in the manufacture of reformed and restructured meat products and describe the science underpinning each step in these processes.
7. Describe the role of micro-organisms in the manufacture of various fermented meat products.
8. Carry out laboratory procedures relevant to the academic content of the module.

How the course addresses the core competencies:
This module (course) addresses the following core competencies:

Food Chemistry and Analysis
It cross-connects to the following content areas within this competency:
- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Chemistry of changes occurring during processing, storage and utilization
- Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients

Food Safety and Microbiology
It cross-connects to the following content areas within this competency:
- Beneficial microorganisms in food systems

Food Processing and Engineering
It cross-connects to the following content areas within this competency:
- Characteristics of raw food material
- Principles of food preservation including low and high temperatures, water activity,
- Engineering principles including mass and energy balances, thermodynamics, fluid flow, and heat and mass transfer
- Principles of food processing techniques, such as freeze drying, high pressure, aseptic processing, extrusion, etc.
Applied Food Science
It cross-connects to the following content areas within this competency:
- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Quality assurance
- Current issues in food science
- Food laws and regulations

Success skills
It cross-connects to the following content areas within this competency:
- Communication skills
- Critical thinking/problem solving skills
- Professionalism skills
- Interaction skills
- Information acquisition skills
- Organizational skills

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., ‘By the completion of food science program, the student should’):
- Understand the chemistry underlying the properties and reactions of various food components
- Have sufficient knowledge of food chemistry to control reactions in foods.
- Understand the major chemical reactions that limit shelf life of foods.
- Be able to use the laboratory techniques common to basic and applied food chemistry.
- Understand the principles behind analytical techniques associated with food.
- Be able to select the appropriate analytical technique when presented with a practical problem.
- Demonstrate practical proficiency in a food analysis laboratory
- Understand the principles involving food preservation via fermentation processes.
- Understand the source and variability of raw food material and their impact on food processing operations.
- Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage.
- Understand the transport processes and unit operations in food processing as demonstrated both conceptually and in practical laboratory settings.
- Understand the unit operations required to produce a given food product.
- Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality.
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Be able to apply the principles of food science to control and assure the quality of food products
- Be aware of current topics of importance to the food industry.
- Understand government regulations required for the manufacture and sale of food products.
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations
- Apply critical thinking skills to new situations
- Work and/or interact with individuals from diverse cultures.
• Work effectively with others.
• Independently research scientific and non-scientific information.
• Competently use library resources.
• Manage time effectively

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

*Tools used to assess learning outcomes (% total mark): Level of assessment (Bloom’s taxonomy)*

- End of year written 1.5 h examination (85%): II-III
- Examination on Laboratory practicals (15%): II-V

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3 years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

*Range over three years (2008-2011)*

- Average mark (out of 100): 48-50
- Minimum: 10-36
- Maximum: 62-81
- % failure at first sitting: 11-17%

Students do not find this module unduly difficult as it involves developing their knowledge of meat science and technology by applying their fundamental knowledge of food constituents to understand muscle-based systems. They enjoy the laboratory sessions and industrial visits which provide students with practical applications of material they have covered in lectures. The University e-learning portal ‘Blackboard’ is used to provide lecture material.
FS4022  Topics in Food Science

Objective of module:  To provide understanding of selected topics relating to fruit and vegetables and dairy chemistry

Brief overview of modules content: Fruit and vegetable composition, structure, respiration and its control. Changes in fruit and vegetables during maturation and ripening. Processing and preservation of fruit and vegetables including effects on quality attributes. Spices and spice products. Selected topics in dairy chemistry.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Describe in detail the chemical composition, physical structure and the different patterns of respiration in fruit and vegetables and how respiration is modulated by refrigeration, controlled atmosphere storage and modified atmosphere packaging.
2. Describe the changes that occur in fruit and vegetable composition, colour and texture during maturation and ripening.
3. Outline in detail the preservation of fruit and vegetables by heat sterilization and by freezing and frozen storage, including the effects of these unit operations on quality attributes.
4. Describe the importance and properties of spices and spice products in the food industry.
5. Describe in detail the chemistry, uses, production and derivatives of lactose and the problems caused by this sugar in dairy processing and nutrition.
6. Outline the components of the milk salts equilibrium and how this is affected by processing and other factors.
7. Explain the relationship between heat stability of milk and pH, describe the changes which occur on heating milk and how processing influences the heat stability of milk.
8. Describe the uses of exogenous enzymes (other than rennet) in dairy processing.
9. Describe the principal indigenous biologically active constituents of milk.

How the course addresses the core competencies:
This module (course) addresses the following core competency:

Food Chemistry and Analysis
It cross-connects to the following content areas within this competency:

- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Chemistry of changes occurring during processing, storage and utilization

Food Processing and Engineering
It cross-connects to the following content areas within this competency:

- Characteristics of raw food material
- Principles of food preservation including low and high temperatures, water activity, etc.
- Packaging materials and methods

Food Processing and Engineering
It cross-connects to the following content areas within this competency:

- Quality assurance
Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., ‘By the completion of food science program, the student should’):

- Understand the chemistry underlying the properties and reactions of various food components
- Have sufficient knowledge of food chemistry to control reactions in foods
- Understand the major chemical reactions that limit shelf life of foods.
- Understand the source and variability of raw food material and their impact on food processing operations.
- Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage.
- Understand the principles that make a food product safe for consumption.
- Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality.
- Understand the properties and uses of various packaging materials.
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Be able to apply the principles of food science to control and assure the quality of food products.
- Apply critical thinking skills to new situations.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

*Tools used to assess learning outcomes: Level of assessment (Bloom’s taxonomy)*

End of year written 1.5 h examination II-V

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

*Range over three years (2008-2011)*

<table>
<thead>
<tr>
<th>Average mark (out of 100):</th>
<th>51-53</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum:</td>
<td>33-40</td>
</tr>
<tr>
<td>Maximum:</td>
<td>69-79</td>
</tr>
<tr>
<td>% failure at first sitting:</td>
<td>0-11%</td>
</tr>
</tbody>
</table>

This module is equally divided between dairy chemistry and the chemistry and preservation of fruits and vegetables. Students find the material stimulating and interesting. Students learn by lectures; all module lectures and associated material are available on the student e-learning portal “Blackboard” or are provided in hard copy.
FS4023 *Food Biopolymer Ingredients and Mixtures*

**Objective of module:** To cover advanced aspects of the physico-chemical properties of food proteins and biopolymer mixtures of proteins and non-protein biopolymers exploited in food processing.


A. Specific learning outcomes, including how the course addresses the core competencies.

1. Describe functional attributes of proteins exploited in processing of specific food materials; discuss recovery of dry protein-enriched ingredient from food materials; state some general aspects considered during recovery of protein-enriched ingredient and on their use in reformulated food products
2. Describe interaction of food proteins with water; discuss hydration, water binding, solubilization and the influence on these of intrinsic and extrinsic factors
3. Discuss the viscous behaviour of protein solutions and the use of food proteins to influence/control viscosity in foods
4. Discuss the use of proteins as gelling/structuring agents in foods; describe mechanisms of food protein gelation; describe microstructural and rheological properties of food protein gels; discuss effects of environmental factors on gelation and gel properties in foods
5. Discuss the surface and interfacial behaviour of proteins; discuss the use of proteins as emulsifying and foaming agents in foods; describe processes used to form food emulsion and foam; discuss food emulsion and foam stability and destabilization processes
6. Describe the interactions that can occur in mixtures of food biopolymers; explain the thermodynamic origin of phase separation, the construction of phase diagrams, and the factors promoting or inhibiting segregation; write the polymer blending laws developed for polymer composites and describe how their application can be extended to biphasic gels.

_How the course addresses the core competencies:_

This module (course) addresses the following core competencies:

**Food Chemistry and Analysis**
It cross-connects to the following content areas within these competencies:
- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Chemistry of changes occurring during processing, storage and utilization

**Food Processing and Engineering**
It cross-connects to the following content areas within these competencies:
- Characteristics of raw food material
- Principles of food preservation including low and high temperatures, water activity, etc.
- Engineering principles including mass and energy balances, thermodynamics, fluid flow, and heat and mass transfer
- Principles of food processing techniques, such as freeze drying, high pressure, aseptic processing, extrusion, etc.
Applied Food Science
It cross-connects to the following content areas within these competencies:
- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Quality assurance
- Current issues in food science

Success Skills
It cross-connects to the following content areas within these competencies:
- Communication skills (i.e., oral and written communication, listening, interviewing, etc.)
- Critical thinking/problem solving skills (i.e., creativity, common sense, resourcefulness, scientific reasoning, analytical thinking, etc.)

Our stated module learning outcomes and the learning experience of students taking this module above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., ‘By the completion of food science program, the student should’):
- Understand the chemistry underlying the properties and reactions of various food components
- Have sufficient knowledge of food chemistry to control reactions in foods
- Understand the major chemical reactions that limit shelf life of foods
- Understand the source and variability of raw food material and their impact on food processing operations
- Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage
- Understand the transport processes and unit operations in food processing as demonstrated both conceptually and in practical laboratory settings
- Understand the unit operations required to produce a given food product
- Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems
- Be able to apply the principles of food science to control and assure the quality of food products
- Be aware of current topics of importance to the food industry
- Demonstrate the use of oral and written communication skills. This includes such skills as writing technical reports, letters and memos; communicating technical information to a nontechnical audience; and making formal and informal presentations
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations
- Apply critical thinking skills to new situations.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

<table>
<thead>
<tr>
<th>Tools used to assess learning outcomes:</th>
<th>Level of assessment (Bloom’s taxonomy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>End of year written 1.5 h examination</td>
<td>II-VI</td>
</tr>
</tbody>
</table>
C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)

<table>
<thead>
<tr>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average mark (out of 100)</td>
<td>52-62</td>
</tr>
<tr>
<td>Minimum</td>
<td>24-32</td>
</tr>
<tr>
<td>Maximum</td>
<td>73-91</td>
</tr>
<tr>
<td>% failure at first sitting</td>
<td>8-12%</td>
</tr>
</tbody>
</table>

This module has been noted by most students as not overly difficult; as the module involves developing an understanding of some of the physico-chemical properties of food proteins, of non-protein biopolymers and of mixtures of proteins and non-protein biopolymers and their exploitation in food processing to control the properties, texture/flow and quality parameters of food, the students appreciate how the topics relate well to aspects of everyday food formulation/processing. Students learn by lectures and tutorial discussion. All module lecture notes are made available on the University e-learning portal, “Blackboard”.
Note: Both MB3003 and MB3014 build on the 10 credit module MB2033.

**MB3003 Food and Industrial Microbiology I**

**Objective of module:** To examine basic concepts and processes in food microbiology.

**Brief overview of modules content:** Characteristics of bacteria, fungi and viruses associated with foods; Factors affecting growth of micro-organisms in foods; methods of food preservation; food safety; food spoilage; HACCP; microbiology of specific foods.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. List and describe the different types of microorganisms typically associated with foods
2. Explain the factors that affect the growth of microorganisms in food environments;
3. Outline the different classical and novel technologies employed by the food industry to control spoilage and pathogenic microorganisms in foods;
4. Describe the microbiology of a range of commodities including milk, meat, vegetables and fruits.

**How the course addresses the core competencies:**

This module (course) addresses the following core competencies:

**Food Safety and Microbiology**
It cross-connects to the following content areas within this competency:
- Pathogenic and spoilage microorganisms in foods
- Influence of the food system on the growth and survival of microorganisms
- Control of microorganisms

**Food Processing and Engineering**
It cross-connects to the following content areas within this competency:
- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)

**Applied Food Science**
It cross-connects to the following content areas within this competency:
- Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
- Current issues in food science
- Food laws and regulations

Our stated module learning outcomes above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., ‘By the completion of food science program, the student should’):
- 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.
- Utilize laboratory techniques to identify microorganisms in foods.
- 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.
- 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.
- Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage.
- Understand the principles that make a food product safe for consumption.
- Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
- Be aware of current topics of importance to the food industry.
- Understand government regulations required for the manufacture and sale of food products.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

<table>
<thead>
<tr>
<th>Tools used to assess learning outcomes (% total mark):</th>
<th>Level of assessment (Bloom’s taxonomy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>End of year written 1.5 h examination (70%)</td>
<td>I-IV</td>
</tr>
<tr>
<td>Laboratory notebook and performance (10%)</td>
<td>II-V</td>
</tr>
<tr>
<td>Multiple choice examination (20%)</td>
<td>I-IV</td>
</tr>
</tbody>
</table>

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

| Range over three years (2008-2011) | Average mark (out of 100): 48-53 | Minimum: 12-37 | Maximum: 70-79 | % failure at first sitting: 4-24% |

This module is generally well received by students as it involves more food-related microbiology which builds on MB2003 in 2nd year. The students also enhance their microbiology laboratory practical skills.
MB3014  Food and Industrial Microbiology II

Objective(s) of module: To present and explore the diversity of scientific disciplines/technologies underpinning industrial fermentations. To investigate several diverse examples of applied industrial fermentations, producing products of significance in students' daily lives. To provide students with hands on experience of lab-scale bioreactor operation and monitoring.

Brief overview of modules content: Bioreactor/fermenter design and different types of fermentations; Industrial production of alcoholic beverages, antibiotics, amino acids, organic acids and enzymes; Food fermentations/Biotechnology; Recombinant protein production; Microbial aspects of GMP in industrial processes.

A. Specific learning outcomes, including how the course addresses the core competencies.
   1. Recall historical developments in the area of industrial fermentation; as well as identifying key products currently generated by the industry.
   2. Outline and discuss the diverse array of science disciplines/technologies which underpin modern, industrial fermentations.
   3. Identify important aspects of bioreactor design/construction.
   4. Describe the characteristics of key microbial species commonly used in industrial fermentations.
   5. Outline and discuss critical operational variables of industrial fermentations.
   6. Compare and contrast the operational characteristics and product recovery procedures of several, real time industrial fermentations.
   7. Demonstrate a practical understanding of lab-scale bioreactor operation, and accurate monitoring/data recording through the construction of precise laboratory reports.

How the course addresses the core competencies:
This module (course) addresses the following core competencies:

Food safety and microbiology
It cross-connects to the following content areas within this competency:
   • Pathogenic and spoilage microorganisms in foods
   • Influence of the food system on the growth and survival of microorganisms
   • Control of microorganisms

Applied Food Science
It cross-connects to the following content areas within this competency:
   • Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)
   • Current issues in food science
   • Food laws and regulations

Our stated module learning outcomes above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., ‘By the completion of food science program, the student should’)
   • 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.
   • Utilize laboratory techniques to identify microorganisms in foods.
• 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.
• 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.
• Understand the principles that make a food product safe for consumption.
• Be able to apply and incorporate the principles of food science in practical, real-world situations and problems.
• Be aware of current topics of importance to the food industry.
• Understand government regulations required for the manufacture and sale of food products.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

Tools used to assess learning outcomes (% total mark): Level of assessment (Bloom’s taxonomy)
End of year written 1.5 h examination (80%) I-IV
Laboratory notebook and performance (10%) II-V
Multiple choice examination (10%) I-IV

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)

Average mark (out of 100): 37-47
Minimum: 9-19
Maximum: 65-70
% failure at first sitting: 19-50%

This module is generally well received by students as it involves again more food-related microbiology, building on MB3014.
MB4011  Microbial Food Safety

Objective of module:  To provide comprehensive information on the prevalence and nature of organisms which cause foodborne diseases.

Brief overview of modules content:  Foodborne pathogenic micro-organisms; epidemiology. Costs and consequences of foodborne diseases; pertinent case studies.

A. Specific learning outcomes, including how the course addresses the core competencies.

1. Describe the nature of epidemiological investigations
2. Identify major food pathogens and high risk foods
3. Recognise major classes of viruses and parasites in food-borne disease.
4. Interpret molecular typing of pathogens

How the course addresses the core competencies:

This module (course) addresses the following core competencies:

Food safety and microbiology
It cross-connects to the following content areas within this competency:
- Pathogenic and spoilage microorganisms in foods
- Influence of the food system on the growth and survival of microorganisms
- Control of microorganisms

Applied Food Science
It cross-connects to the following content areas within this competency:
- Current issues in food science
- Food laws and regulations

Success Skills
It cross-connects to the following content areas within this competency:
- Critical thinking/problem solving skills
- Information acquisition skills

Our stated module learning outcomes above align closely with the following stated IFT ‘learning outcomes’ within these core competencies (i.e., ‘By the completion of food science program, the student should’)

- Identify the important pathogens and spoilage microorganisms in foods and the conditions under which they will grow.
- 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.
- 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.
- Be aware of current topics of importance to the food industry.
- Understand government regulations required for the manufacture and sale of food products.
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.
- Apply critical thinking skills to new situations.
- Independently research scientific and nonscientific information.
- Competently use library resources.
B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

<table>
<thead>
<tr>
<th>Tools used to assess learning outcomes</th>
<th>Level of assessment (Bloom’s taxonomy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>End of year written 1.5 h examination</td>
<td>II-VI</td>
</tr>
</tbody>
</table>

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)

<table>
<thead>
<tr>
<th>Average mark (out of 100)</th>
<th>Minimum:</th>
<th>Maximum:</th>
<th>% failure at first sitting:</th>
</tr>
</thead>
<tbody>
<tr>
<td>57-59</td>
<td>31-40</td>
<td>70-86</td>
<td>0-10%</td>
</tr>
</tbody>
</table>

This module is generally well received by students as builds on their microbiology understanding from MB3003 and MB3014.
PE2006  Process Engineering Principles

Objective of module: To provide a basic knowledge of fluid flow, heat and mass transfer, mass and energy balances, and how they are applied in engineering calculations.

Brief overview of modules content: Engineering dimensions and units. Conservation of mass and energy: mass balances; energy balances; applications in food industry. Fluid mechanics: fluid statics, fluid dynamics; Bernouilli equation; laminar and turbulent flow; flow in pipes and fittings, pumps and compressors. Heat transfer: heat conduction, convection and radiation; heat exchanger calculations; heat transfer involving phase changes. Mass transfer: molecular diffusion; convective mass transfer. Psychrometry.

A. Specific learning outcomes, including how the course addresses the core competencies.
   1. Work with different systems of units
   2. Perform basic calculations on unit operations with mass and energy balances
   3. Perform basic calculations on fluid flow and heat transfer problems
   4. Identify the basic elements of electrical supply and instrumentation.

How the course addresses the core competencies: This module (course) addresses the following core competencies:

Food Processing and Engineering
It cross-connects to the following content areas within this competency:
   • Engineering principles including mass and energy balances, thermodynamics, fluid flow, and heat and mass transfer

Applied Food Science
It cross-connects to the following content areas within this competency:
   • Computer skills

Our stated module learning outcomes above align closely with the following stated IFT learning outcomes within these core competencies (i.e., ‘By the completion of food science program, the student should’):
   • Understand the transport processes and unit operations in food processing as demonstrated both conceptually and in practical laboratory settings.
   • Be able to use the mass and energy balances for a given food process.
   • Understand the unit operations required to produce a given food product
   • Know how to use computers to solve food science problems.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom’s taxonomy)

Tools used to assess learning outcomes (% total mark): Level of assessment (Bloom’s taxonomy)
End of year written 1.5 h examination (60%) I-III
Laboratory notebook and performance (40%) II-V
C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3-years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)

Average mark (out of 100): 76-81
Minimum: 31-56
Maximum: 87-91
% failure at first sitting: 0-4%

This module is generally well received by students as it introduces students to food engineering.
PE2007  Unit Operations in Process & Chemical Engineering

**Objective of module:** To develop a quantitative process/chemical engineering treatment of selected unit operations of importance in the Food Industry.


A. Specific learning outcomes, including how the course addresses the core competencies.

1. Identify the principles of operation of the unit operations covered in the programme
2. Perform basic calculations and analysis of these unit operations
3. Identify the basic elements of electrical supply and instrumentation.

How the course addresses the core competencies:
This module (course) addresses the following core competencies:

**Food Processing and Engineering**
It cross-connects to the following content areas within this competency:
- Engineering principles including mass and energy balances, thermodynamics, fluid flow, and heat and mass transfer
- Principles of food processing techniques, such as freeze drying, high pressure, aseptic processing, extrusion, etc.

**Applied Food Science**
It cross-connects to the following content areas within this competency:
- Computer skills

**Success Skills**
It cross-connects to the following content areas within this competency:
- Critical thinking/problem solving skills

Our stated module learning outcomes above align closely with the following stated IFT learning outcomes within these core competencies (i.e., "By the completion of food science program, the student should")
- Understand the transport processes and unit operations in food processing as demonstrated both conceptually and in practical laboratory settings.
- Be able to use the mass and energy balances for a given food process.
- Understand the unit operations required to produce a given food product
- Understand the principles and current practices of processing techniques and the effects of processing parameters on product quality.
- Know how to use computers to solve food science problems.
- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.
- Apply critical thinking skills to new situations.

B. Tools used to assess learning outcomes (portfolios, oral presentations, papers, reports, projects, academic journals, quizzes and exams, etc.), indicating level of assessment (e.g., Bloom's taxonomy)
Tools used to assess learning outcomes (% total mark):  Level of assessment (Bloom’s taxonomy)
End of year written 1.5 h examination (60%)  I-III
Practicals, Laboratory Work, Projects, Reports,  II-V
Essay Seminars, Schoolal Tests (40%) 

C. Brief summary of assessment results to date

The following is an overview of the performance of students in this module (course) over the last 3 years using the tools to assess the learning outcomes as indicated above. We present the average as well as minimum and maximum marks achieved, and the % failure rate:

Range over three years (2008-2011)
Average mark (out of 100):  53-60
Minimum:  11-35
Maximum:  76-87
% failure at first sitting:  6-24%

This module is generally well received by students as it introduces students to further aspects of food engineering.
IX. Program outcomes and assessments (1-3 pages)

For the program as a whole:

A. Specific outcomes

**Explanatory note to HERB:** We have developed *Programme Learning Outcomes* (outlined below), which were approved at School level and also by the Faculty of Food Science & Technology, and ultimately at University level. These are:

On successful completion of the *BSc Food Science* programme at University College Cork, we expect students should be able to:

- Identify, analyse and solve problems in food science using knowledge of biological and physical sciences and technology.
- Describe the chemistry of the major constituents of food systems, and relate the presence of these constituents to food properties.
- Explain the principles behind microbial processes in food systems, including adaptation and environmental factors, fermentation, spoilage and pathogenicity, and relate these to processes for production of safe, stable food systems.
- Describe unit operations used in food processing and the effects of processing parameters on product quality.
- Explain the principles of, and apply in practice, techniques in food analysis.
- Plan, conduct, evaluate and report research in food science.
- Work effectively as an individual, in teams and in multi-disciplinary settings, in particular in the context of research or food product/process development, and with an appreciation of the structure and operation of the modern food industry.
- Develop the capacity to undertake lifelong learning.
- Communicate effectively with the food industry and with society at large.

These programme level outcomes cover the indicative IFT core competency areas and make for a well-rounded and professional modern Food Science graduate.

B. Tools used to assess program outcomes (exit interviews or examinations, alumni surveys, employer surveys, food industry advisory boards, etc.)

The tools/approaches used to assess the programme outcomes include:

- Input of a dedicated External Examiner for the *BSc Food Science* programme in evaluating teaching quality and conduct examinations. The External Examiner participates actively in the examination process, including:
  - approval of examination papers.
  - assessment of scripts.
  - Viva voce (exit oral) examinations of final year students
  - finalisation of marks.

  In addition, at the end of the extern visit each year, the external examiner completes a University-level form which provides his/her comments and feedback (**Appendix VI**).

- The use of Work Placement (FS3001) evaluation forms completed by industry mentors and academic mentors (example supplied in **Appendix IV**).
• The use of student feedback questionnaires on programme (administered anonymously and online; example supplied in Appendix VII).

• Employer and past graduate surveys as part of the Quality Review of the School and its teaching and learning, research and administrative activities. These reviews are undertaken by each academic unit every 5 years under the Irish Universities Act 1997.

• Feedback from the External Peer Review Group in the form of the Peer Review Report, as part of the Quality Review exercise.

• Employment data from our Student Careers office.

• Feedback from a dedicated UCC-Food Industry Partnership Board, a special arrangement where representatives of the four largest Irish Food Industry players meet faculty representatives and University officials to guide UCC in its food-related mission in education and research. This forum provides a valuable industry-related insight into our BSc Food Science and calibre of its graduates.

• Formal and informal feedback from other nation and International industry contacts.

The above tools and approaches contribute to the assurance of quality in undergraduate teaching and the attainment by our graduates of the specified programmatic learning outcomes.

C. Brief summary of assessment results to date

• The External Examiner (Professor Peter Lillford, UK) has indicated in his annual reports that feels the programme is one of the highest quality courses compared to those in the United Kingdom. We include excerpts of External Examiner’s report from last year (academic year 2009/10) in Appendix VI. This report from Prof Lillford’s is a good representative report as it was his fourth year as extern by which time he had a very good understanding of our programme and our students’ performance. The excerpts provide some expanded views on our programme and our students’ performance. He has expressed some concern at the failure rate in 1st year of both Chemistry and Physics. We have take some steps to address this (see below in Section X B). This seems particularly problematic for those students who don’t enter University without Chemistry or Physics.

• The Peer Review Group in the report following their review visit of the School in 2010 commended the staff of the School of Food and Nutritional Sciences for their commitment to quality in teaching and learning.

• As mentioned previously, we have received very positive feedback from Food Industry mentors on our students’ performance during their Work Placement (FS3001). The students, while only third years, are well equipped to undertake the placement which tends in general to be very close to the activities undertaken in Industry by full-time employees. We have also received very positive feedback from our surveys of employers as part of our Quality Reviews. These employers include industries and companies which take our graduates as opposed to just work placement.

• Our surveys of past graduates, as part of the Quality Reviews, have also shown that our students have gained important posts within the Food and related industries, which most will attribute to the fact that employers hold the Food Science course at University College Cork in very high regard.
The data from the University-level undergraduate student on-line questionnaire, administered in 2009 (as part of our Quality Review) and again this year (on our request as we found the information particularly useful), suggests Overall satisfaction ratings with the programme were consistently high at 70-80% over the four years and students indicating between very good to good level of satisfaction (Question on Overall satisfaction in Appendix VII). The questionnaire also queries aspects of lecture delivery, notes, laboratory practicals and project work, as well as leaving an opportunity for students to provide any feedback they feel relevant. These surveys are very useful for identifying any issues that students highlight and which we can in general easily address so as to improve their learning experience.

Data from our student careers office as part of their report on Employment/Destination of Graduates suggest that the Food Science programme provides high quality graduates for the food and related industries, education and research institutions and agencies in the public service. The graduates have considerable success in obtaining employment with national and international companies and in gaining entry to postgraduate programmes. The first destinations of graduates for period 2007-09:

<table>
<thead>
<tr>
<th>BSc Food Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
</tr>
<tr>
<td>Employed….</td>
</tr>
<tr>
<td>Further study….</td>
</tr>
<tr>
<td>Seeking employment….</td>
</tr>
<tr>
<td>Not available for work/study…</td>
</tr>
</tbody>
</table>

The UCC-Food Industry Partnership Board has provided valuable advice on what new areas might be considered within the Food Science programme. For example, in the past they highlighted the food packaging area as one they felt was very important to them and in fact provided 5 years of seed funding for a lectureship post in this area, which was subsequently taken up by the University. The UCC-Food Industry Partnership Board has provided financial resources in relation to student recruitment to the Food Science programme. A Schools liaison officer was funded through the Partnership Board. This is important in light of the international down turn in interest of school leavers to a career in the Food Industry which now had thankfully begun to change again due to global economic circumstances and enhanced interest in the food sector in terms of employment opportunities.
X. Use of Results to Improve Learning (1-2 pages)

A. Plan for using assessment results to improve student learning through curricular modifications

- Much of what we have learnt from assessment results have been put in place already (see Part B below for examples) and these in general relate to changes within modules (courses) and less to the programme curriculum per se.

- However, we have performed a review of the programme curriculum in terms of possible modifications over the last 12 months. The following potential modifications have been highlighted and will be considered further over the next academic year:
  - That the milk quota system in Ireland and elsewhere within the European Union is due to change within the next two years. Thus, the emphasis on dairying and the dairy sector of the Irish food industry, including need for graduates in this area, has led us to question whether we need to diversify our programme such that there is a Dairy Science & Technology Option (Emphasis within the degree). Should we decide to alter the programme structure to facilitate this we would clearly interact with IFT’s HERB in terms of potentially re-submitting that new Option. We have also explored a possible Taught MSc (Masters in Science) route to allow BSc Food Science graduates specialize in the Dairy area.
  - We have also explored the possibility of inclusion of new material on molecular gastronomy and applied food physics in a final year module, in line with evolution of many Food Science programmes in European and US universities. It is clear both that many of the areas of expertise and teaching in the School can be applied to cooking as well as to industrial scenarios, and that food companies in Ireland and elsewhere are looking for graduates who have expertise in this area. In this regard, linkages with leading universities active in this area on both sides of the Atlantic have been developed, with a view to introducing such developments in the academic year 2012/13.

- We have also considered developing a second Food Science module in 1st year of the programme which would have an emphasis on translation of chemistry and physics concepts to food science. Examples of how some of the core principals in both these subjects are at the heart of food chemistry and technology would orientate the students and illustrate better the need for both physics and chemistry for any future food scientist. We had also considered using more Nutrition examples within this module.

- We had also felt with the growing European (if not western world) dilemma of production of more food but contributing less to the carbon footprint in so doing, that we needed to emphasize this major challenge within the later parts of our programme. Thus, the environmental impact of food production is an area we felt needed to have some more content within the programme. As part of this IFT application and a re-assessment of our programme with respect to where the core competencies were covered within our modules, we can see that one aspect of this, water and waste treatment, is an area which we should include more lectures on. These could be included in the following set of modules and in the FS modules we may invite in a guest lecturer from industry:
  - MB3003/MB3014
  - PE2006/PE2007
  - FS3006/FS4022
B. Brief summary of improvements, modifications, etc. to date

- The majority of students who enter the Food Science programme in first year have not taken Chemistry or Physics in their Leaving Certificate examination (State exit examination from Secondary education system) and hence find these subjects challenging. There have been ongoing discussions with the School of Chemistry and School of Physics who provide CM1005 and PY1008, respectively, in order to provide more support for first year Food Science students taking these modules. In the past two years, the Chemistry School has provided our students with a peer-assisted learning support programme whereby students majoring in Chemistry provide small group tutorials covering all aspects of CM1005. The Chemistry School has also provided our students with an on-line programme of homework assignments which are designed to support their Chemistry learning experience and develop their knowledge in a stepwise and student friendly manner. The feedback from students regarding these initiatives has been very positive. The Physics School now also provides tutorials to support students learning.

- While the skills taught in FS2001 are of key importance to the training of our students as Food Scientists, in recent years many of the students find the numerical and problem-solving approach in this module difficult. In order to encourage students to develop these vital skills and to support their learning, from this academic year onwards students will be provided with home work assignments which will encourage them to improve their numeracy and problem-solving skills in a step wise manner. These homework assignments will be supported by tutorials.

- Over a number of years we have noted that many students while on work placement were required to carry out literature searches on industry-related topics. In addition our Final year students noted that it was difficult to prepare a literature review for their Research Project (FS4001) as they had little training on how to search the literature and formulate a literature review. In order to support the learning experience of students in this element of the programme, a library project was introduced as an element of FS2004. Workshops are provided to instruct students on how to independently research scientific and non-scientific information, how to write a literature review and compile a bibliography. In addition, training sessions are provided by staff of the University library on how to competently use the library resources. Each student is assigned a project supervisor who provides help and advice regarding the library project. The student submits a first draft of the library project which is corrected by the supervisor who then meets the student and discusses what changes/corrections need to be made. The student then has an opportunity to submit a second draft of the library project which is also graded. Students find this exercise very worthwhile as it develops their ability to search the literature, distill information, write scientifically and prepare a bibliography.
Appendices
Appendix I: *Description of facilities at the School of Food and Nutritional Sciences*
Appendix II: Overview of the BSc Food Science programme at University College Cork and some additional information on courses

The BSc Food Science at University College Cork is a 4-year honours degree programme consisting of 60 credits per year (240 credits for full programme; see below). A 5-credit course (called ‘module’) is the primary academic block and would generally consist of 24 hours of lectures and may or may not have associated laboratory sessions (see below).

The ‘Food Science’ Faculty is located in three administrative units: the School of Food and Nutritional Sciences – the anchor academic unit for the BSc Food Science programme – also including an Associated School of Food Business and Development; the School of Microbiology; and the School of Chemical and Process Engineering. These units cover the delivery of core competencies in the Core required Food Science modules. In addition, the Background courses listed below, offered by a variety of different academic units within the University, cover the required basics/subjects (we have indicated the courses which map significantly to the core competencies; other courses may touch on some aspects of the core competencies to a lesser degree):

A. Background courses

1. Chemistry (Two courses in general chemistry followed by one course each in organic chemistry and biochemistry):
   - CM1005 Introductory Chemistry for Food and Nutritional Sciences (15 credits)
     - This is equivalent to 2-3 courses in general chemistry, and includes physical chemistry and organic chemistry.
   - BC2001 Biomolecules (5 credits)
     - This is organic chemistry and covers structures of carbohydrates, proteins (including enzymes), and lipids as well as isomers and properties in water.
   - BC2002 Principles of Metabolic Pathways (5 credits)
     - This covers general biochemistry.

Analytical and physical chemistry is also included in core modules (see below).

2. Biological Sciences (One course (three modules) in biology, and one course in general microbiology that has a laboratory):
   - BL1002 Cells, Biomolecules, Genetics and Evolution (5 credits)
   - BL1003 Introduction to Biological Chemistry and Microbiology (5 credits)
   - BL1004 Physiology and Structure of Plants and Animals (5 credits)
   - MB2003 Fundamental Principles of Microbiology (10 credits)
   - These four modules cover biology and general microbiology, including a laboratory.

3. Nutrition (One course (two modules) dealing with the basic concepts of human nutrition and the relationship of consumption of foods to health and well-being):
   - NT2004 Principles of Nutrition (5 credits)
   - NT4010 Topics in Nutrition and Food Toxicology (5 credits)
   - These two modules cover the basic concepts of human nutrition and aspects of health and well-being.

4. Physics and Mathematics (One course in calculus and one in general physics):
   - MA1003 Introductory Mathematics and Applied Mathematics (10 credits)
   - PY1008 Physics for Biomedical, Environmental, Food and Nutritional Sciences (10 credits)

5. Statistics (One course.)
   - ST2001 Introduction to Biostatistics (5 credits)
BSc (Hons) (FOOD SCIENCE) DEGREE

Year 1:

- **BL1002** Cells, Biomolecules, Genetics and Evolution (5 credits)
- **BL1003** Introduction to Biological Chemistry and Microbiology (5 credits)
- **BL1004** Physiology and Structure of Plants and Animals (5 credits)
- **CM1005** Introductory Chemistry for Food and Nutritional Sciences (15 credits)
- **FE1301** Introduction to Food Supply Chains (5 credits)
- **FS1001** Introduction to Food Science and Technology (5 credits)
- **MA1003** Introductory Mathematics and Applied Mathematics (10 credits)
- **PY1008** Physics for Food, Nutritional and Environmental Sciences (10 credits)

Year 2:

- **BC2001** Biomolecules (5 credits)
- **BC2002** Principles of Metabolic Pathways (5 credits)
- **FS2001** Introductory Food Chemistry - Analytical Methods (5 credits)
- **FS2002** Introductory Food Chemistry: Food Constituents (5 credits)
- **FS2003** Introductory Food Chemistry: Selected Topics in Physical Chemistry (5 credits)
- **FS2004** Topics in Food Quality and Legislation A (5 credits)
- **MB2003** Fundamental Principles of Microbiology (10 credits)
- **NT2004** Principles of Nutrition (5 credits)
- **PE2006** Process Engineering Principles (5 credits)
- **PE2007** Unit Operations in Process & Chemical Engineering (5 credits)
- **ST2001** Introduction to Biostatistics (5 credits)

Year 3:

- **FS3001** Work placement (10 credits)
- **FS3002** Chemistry of Food Proteins (5 credits)
- **FS3003** Chemistry and Technology of Oils and Fats (5 credits)
- **FS3004** Sensory Analysis, Flavour and Colour (5 credits)
- **FS3005** Macromolecules and Rheology (5 credits)
- **FS3006** Food Processing and Preservation (10 credits)
- **FS3007** Dairy Product Technology (5 credits)
- **FS3008** Fundamentals of Food Packaging (5 credits)
- **MB3003** Food and Industrial Microbiology I (5 credits)
- **MB3014** Food and Industrial Microbiology II (5 credits)

Year 4: Food Chemistry and Processing Technology (Option)

- Students take 15 credits as follows:
  - **FS4001** Research Project (10 credits)
  - **FS4003** Advanced Analytical Methods (5 credits)
  - or
  - **FS4002** Team Product Development Project (10 credits)
  - **FS4014** Food Product Development and Innovation (5 credits)
- **Plus 45** credits as follows:
  - **FS4006** Cereals and Related Beverages (5 credits)
  - **FS4010** Food Shelf Life Control (5 credits)
  - **FS4011** Advanced Food Packaging (5 credits)
  - **FS4020** Dairy Science and Technology (5 credits)
  - **FS4021** Meat Science and Technology (5 credits)
  - **FS4022** Topics in Food Science (5 credits)
  - **FS4023** Food Biopolymer Ingredients and Mixtures (5 credits)
  - **NT4010** Topics in Nutrition and Food Toxicology (5 credits)
  - **MB4011** Microbial Food Safety (5 credits)
A. Background courses (continued)

6. Communications (A course generally taught outside of the formal University –based aspects of the Food Science programme, and that provide the fundamentals of speaking and writing skills):

*FS3001 Work Placement*
- This is a module that besides the Work Placement itself provides with comprehensive communication skills.
- This module is emphasizing the fundamentals of communications and is not a core Food Science course as such and it is included in all Food-related BSc programmes of the University. Communications (both written and oral) are also included in core modules (see below).

B. Core Competencies in Food Science

1. Food Chemistry and Analysis *(and where these are covered in our modules)*
   (i) Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives.
   *FS1001 Introduction to Food Science and Technology (5 credits)*
   *FS2002 Introductory Food Chemistry: Food Constituents (5 credits)*
   *FS3002 Chemistry of Food Proteins (5 credits)*
   (ii) Chemistry of changes occurring during processing, storage and utilization.
   *FS2003 Introductory Food Chemistry - Selected Topics in Physical Chemistry (5 credits)*
   *FS3003 Chemistry and Technology of Oils and Fats (5 credits)*
   *FS4010 Food Shelf Life Control (5 credits)*
   *FS4020 Dairy Science and Technology (5 credits)*
   (iii) Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients.
   *FS2001 Introductory Food Chemistry - Analytical Methods (5 credits)*

2. Food safety and microbiology
   (i) Pathogenic and spoilage microorganisms in foods
   *MB2003 Fundamental Principles of Microbiology (10 credits)*
   *MB3003 Food and Industrial Microbiology I (5 credits)*
   *MB4011 Microbial Food Safety (5 credits)*
   (ii) Beneficial microorganisms in food systems
   *MB3014 Food and Industrial Microbiology II (5 credits)*
   *FS4021 Meat Science and Technology (5 credits)*
   (iii) Influence of the food system on the growth and survival of microorganisms
   *MB3003 Food and Industrial Microbiology I (5 credits)*
   (iv) Control of microorganisms
   *MB3003 Food and Industrial Microbiology I (5 credits)*

3. Food processing and engineering
   (i) Characteristics of raw food material
   *FS1001 Introduction to Food Science and Technology (5 credits)*
   *FS2004 Topics in Food Quality and Legislation A (5 credits)*
   *FS3003 Chemistry and Technology of Oils and Fats (5 credits)*
   *FS3007 Dairy Product Technology (5 credits)*
   *FS4006 Cereals and Related Beverages (5 credits)*
   *FS4021 Meat Science and Technology (5 credits)*
(ii) Principles of food preservation including low and high temperatures, water activity, etc.  
   *FS3006 Food Processing and Preservation (10 credits)*  
   *FS3007 Dairy Product Technology (5 credits)*  
   *FS4021 Meat Science and Technology (5 credits)*  

(iii) Engineering principles including mass and energy balances, thermodynamics, fluid flow, and heat and mass transfer  
   *PE2006 Process Engineering Principles (5 credits)*  

(iv) Principles of food processing techniques, such as freeze drying, high pressure, aseptic processing, extrusion, etc.  
   *PE2007 Unit Operations in Process & Chemical Engineering (5 credits)*  
   *FS3003 Chemistry and Technology of Oils and Fats (5 credits)*  
   *FS3006 Food Processing and Preservation (10 credits)*  

(v) Packaging materials and methods  
   *FS3008 Fundamentals of Food Packaging (5 credits)*  
   *FS4011 Advanced Food Packaging (5 credits)*  

(vi) Cleaning and sanitation  
   *FS3006 Food Processing and Preservation (10 credits)*  

(vii) Water and waste management  
   *FS2002 Introductory Food Chemistry: Food Constituents (5 credits)*  

4. Applied food science  

   (i) Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.)  
   *FS3003 Chemistry and Technology of Oils and Fats (5 credits)*  
   *FS3005 Macromolecules and Rheology (5 credits)*  
   *FS4001 Research Project (10 credits)*  
   *FS4002 Team Product Development Project (10 credits)*  
   *FS4003 Advanced Analytical Methods (5 credits)*  
   *FS4006 Cereals and Related Beverages (5 credits)*  
   *FS4010 Food Shelf Life Control (5 credits)*  
   *FS4011 Advanced Food Packaging (5 credits)*  
   *FS4020 Dairy Science and Technology (5 credits)*  
   *FS4023 Food Biopolymer Ingredients and Mixtures (5 credits)*  

   (ii) Computer skills  
   *FS4001 Research Project (10 credits)*  
   *FS4002 Team Product Development Project (10 credits)*  
   *FS4003 Advanced Analytical Methods (5 credits)*  

   (iii) Statistical skills  
   *FS4001 Research Project (10 credits)*  
   *FS4002 Team Product Development Project (10 credits)*  
   *FS4003 Advanced Analytical Methods (5 credits)*  

   (iv) Quality assurance  
   *FS2004 Topics in Food Quality and Legislation A (5 credits)*  

   (v) Analytical and affective methods of assessing sensory properties of food utilizing statistical methods  
   *FS3004 Sensory Analysis, Flavour and Colour (5 credits)*  

   (vi) Current issues in food science  
   *FS4022 Topics in Food Science (5 credits)*  

   (vii) Food laws and regulations  
   *FE1301 Introduction to Food Supply Chains (5 credits)*
5. Success skills

(i) Communication skills (i.e., oral and written communication, listening, interviewing, etc.)
   - FS4001 Research Project (10 credits)
   - FS4002 Team Product Development Project (10 credits)

(ii) Critical thinking/problem solving skills (i.e., creativity, common sense, resourcefulness, scientific reasoning, analytical thinking, etc.)
   - FS4001 Research Project (10 credits)
   - FS4002 Team Product Development Project (10 credits)

(iii) Professionalism skills (i.e., ethics, integrity, respect for diversity)
   - FS4001 Research Project (10 credits)
   - FS4002 Team Product Development Project (10 credits)

(iv) Life-long learning skills
   - FS4001 Research Project (10 credits)
   - FS4002 Team Product Development Project (10 credits)

(v) Interaction skills (i.e., teamwork, mentoring, leadership, networking, interpersonal skills, etc.)
   - FS3001 Work Placement
   - FS4001 Research Project (10 credits)
   - FS4002 Team Product Development Project (10 credits)

(vi) Information acquisition skills (i.e., written and electronic searches, databases, Internet, etc.)
   - FS2004 Topics in Food Quality and Legislation A (5 credits)
   - FS4001 Research Project (10 credits)
   - FS4002 Team Product Development Project (10 credits)

(vii) Organizational skills (i.e., time management, project management, etc.)
   - FS4001 Research Project (10 credits)
   - FS4002 Team Product Development Project (10 credits)
   - FS4014 Food Product Development and Innovation (5 credits)
### Appendix III: Hard-copy of course (module) descriptions for School-level FS courses

**UCC**  
Book of Modules 2010/2011  
FSXXXX

**Choose by Subject Category or Module Code:**

- FS1001 Introduction to Food Science and Technology
- FS2001 Introductory Food Chemistry - Analytical Methods
- FS2002 Introductory Food Chemistry: Food Constituents
- FS2003 Introductory Food Chemistry - Selected Topics in Physical Chemistry
- FS2004 Topics in Food Quality and Legislation A
- FS3001 Work Placement
- FS3002 Chemistry of Food Proteins
- FS3003 Chemistry and Technology of Oils and Fats
- FS3004 Sensory Analysis, Flavour and Colour
- FS3005 Macromolecules and Rheology
- FS3006 Food Processing and Preservation
- FS3007 Dairy Product Technology
- FS3008 Fundamentals of Food Packaging
- FS4001 Research Project
- FS4002 Team Product Development Project
- FS4003 Advanced Analytical Methods
- FS4006 Cereals and Related Beverages
- FS4010 Food Shelf-Life Control
- FS4011 Advanced Food Packaging
- FS4014 Food Product Development and Innovation
- FS4020 Dairy Science and Technology
- FS4021 Meat Science and Technology
- FS4022 Topics in Food Science
- FS4023 Food Bipolymer Ingredients and Mixtures
FS1001 Introduction to Food Science and Technology

Credit Weighting: 5

Teaching Period(s): Teaching Periods 1 and 2.

No. of Students: -

Pre-requisite(s): None

Co-requisite(s): None

Teaching Methods: 24 x 1hr(s) Lectures; 8 x 4hr(s) Practicals.

Module Co-ordinator: Dr Eileen O’Neill, School of Food and Nutritional Sciences.

Lecturer(s): Staff, School of Food and Nutritional Sciences.

Module Objective: To provide students with an introduction to key aspects of Food Science and Technology.

Module Content: Lectures will focus on aspects of the chemistry, microbiology and processing of foods.

Learning Outcomes: On successful completion of this module, students should be able to:
· Outline the main ways in which primary production of food is of importance to food product quality
· Describe the general features and importance of proteins, lipids and carbohydrates in foods
· Describe the reasons why food is processed
· Apply the above basic knowledge of food ingredients and processing operations to describe how cheese, emulsions and milk powder are made
· Discuss the concept of functional foods
· Explain food and nutritional labelling
· Identify the important roles, both beneficial and detrimental, played by micro-organisms in the food industry
· Explain the costs and consequences of food-borne disease.

Assessment: Total Marks 100: End of Year Written Examination 90 marks; Continuous Assessment 10 marks (minor project).

Compulsory Elements: End of Year Written Examination; Continuous Assessment.

Penalties (for late submission of Course/Project Work etc.): Work which is submitted late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

Pass Standard and any Special Requirements for Passing Module: 40%.

End of Year Written Examination Profile: 1 x 1½ hr(s) paper(s).

Requirements for Supplemental Examination: 1 x 1½ hr(s) paper(s) to be taken in Autumn. The mark for Continuous Assessment is carried forward.
FS2001 Introductory Food Chemistry - Analytical Methods

Credit Weighting: 5

Teaching Period(s): Teaching Periods 1 and 2.

No. of Students:

Pre-requisite(s): None

Co-requisite(s): None

Teaching Methods: 24 x 1hr(s) Lectures; 80 x 1hr(s) Practicals; 10 x 1hr(s) Tutorials.

Module Co-ordinator: Dr Eileen O'Neill, School of Food and Nutritional Sciences.

Lecturer(s): Dr Eileen O'Neill, School of Food and Nutritional Sciences.

Module Objective: To provide an introduction to basic concepts and applications of analytical techniques relevant to Food Chemistry.


Learning Outcomes: On successful completion of this module, students should be able to:

· Describe the behaviour of acids, bases and buffers
· Calculate the concentration of solutions and be able to prepare standard solutions
· Outline the principle and procedures involved in the determination of the concentration of salt in foods
· Balance redox equations
· Outline the principles involved in the use of redox titrations to determine (i) the concentration of reducing sugars, (ii) the available chlorine in bleach and (iii) the polluting potential of waste water
· Describe the use of complexiometric titrations to determine water hardness
· Outline the principle and applications of electrochemical analytical techniques
· Describe the principle and applications of spectroscopy and chromatography in food analysis
· Carry out appropriate experiments safely in the laboratory, make accurate observations and write scientific reports.

Assessment: Total Marks 100: Continuous Assessment 100 marks (In-class Tests 90 marks; Laboratory notebook and performance 10 marks).

Compulsory Elements: Continuous Assessment. Attendance at Laboratory Practicals.

Penalties (for late submission of Course/Project Work etc.): Work which is submitted late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

Pass Standard and any Special Requirements for Passing Module: 40% - Students must demonstrate a minimum satisfactory performance in the practical component of the module by attending the practical sessions at the time and date scheduled, undertaking the practical and submitting a practical report for at least 80% of the practical sessions. Students not meeting this requirement will be debarred from the Schoolal tests in the module and from the Autumn Supplemental Examination in the module. A student will be warned when s/he has failed to fulfill the above criteria for more than 10% of practical sessions.
End of Year Written Examination Profile: No End of Year Written Examination.

Requirements for Supplemental Examination: Mark for the Laboratory notebook and performance component of Continuous Assessment is carried forward. Other failed elements of Continuous Assessment must be repeated as 1 x 1½hr written.

FS2002 Introductory Food Chemistry: Food Constituents

Credit Weighting: 5

Teaching Period(s): Teaching Periods 1 and 2.

No. of Students: Max 60.

Pre-requisite(s): None

Co-requisite(s): None

Teaching Methods: 24 x 1hr(s) Lectures.

Module Co-ordinator: Professor Paul McSweeney, School of Food and Nutritional Sciences.

Lecturer(s): Staff, School of Food and Nutritional Sciences.

Module Objective: To introduce students to the fundamentals of the structural chemistry of food constituents

Module Content: Structural chemistry of proteins, lipids and carbohydrates

Learning Outcomes: On successful completion of this module, students should be able to:

· Describe the role of carbohydrates, proteins and lipids as the principal constituents of the human diet, and give their approximate content in common foods and beverages

· Outline the principles, advantages and disadvantages of common methods for quantitative determination of proteins. Draw the structures of the amino acid as subunits of proteins, outline their properties and reactions

· Describe the pH-dependent changes to amino acids and peptides and the principal factors that affect the solubility of proteins in water

· Describe the primary, secondary and tertiary structures of proteins, giving examples where appropriate; define protein denaturation; describe the biological, physical and chemical changes that occur on denaturation, and the principal agents that cause denaturation

· Define the term "lipid" and list the main categories of lipid molecules in food systems; outline the systems of nomenclature applied to fatty acids; describe and draw the structures of the most commonly-occurring fatty acids in foods, and outline their key physical and chemical properties, including the principal factors that influence their melting behaviour

· Distinguish between monoglycerides, diglycerides and triglycerides and draw their structures; describe the key distinguishing features and properties of polar lipids and draw their structures, indicating hydrophilic and hydrophobic regions

· Outline the key chemical properties of carotenoids and sterols, draw their general structure and describe their significance in foods

· Describe the structures, laboratory synthesis and principal chemical reactions of monosaccharides, including interconversion between open chain and ring forms and formation of glycosidic bonds

· Outline the structures, sources and properties of the main polysaccharides used in the food industry, and the structures of disaccharides and oligosaccharides of importance in nature
and in the human diet.

**Assessment:** Total Marks 100: End of Year Written Examination 100 marks.

**Compulsory Elements:** End of Year Written Examination.

**Penalties (for late submission of Course/Project Work etc.):** None.

**Pass Standard and any Special Requirements for Passing Module:** 40%.

**End of Year Written Examination Profile:** 1 x 1½ hr(s) paper(s).

**Requirements for Supplemental Examination:** 1 x 1½ hr(s) paper(s) to be taken in Autumn.

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**FS2003 Introductory Food Chemistry - Selected Topics in Physical Chemistry**

**Credit Weighting:** 5

**Teaching Period(s):** Teaching Periods 1 and 2.

**No. of Students:** Max 85.

**Pre-requisite(s):** None

**Co-requisite(s):** None

**Teaching Methods:** 24 x 1hr(s) Lectures; 6 x 1hr(s) Tutorials; 3 x 4hr(s) Practicals.

**Module Co-ordinator:** Dr Eileen O’Neill, School of Food and Nutritional Sciences.

**Lecturer(s):** Staff, School of Food and Nutritional Sciences.

**Module Objective:** To introduce students to selected topics in physical chemistry of relevance to the understanding of the science and technology of food systems.


**Learning Outcomes:** On successful completion of this module, students should be able to:

- Discuss molecular behaviour and factors that influence this behaviour
- Apply knowledge of thermodynamics, including the concepts of internal energy, heat, work, enthalpy, entropy, and free (Gibbs) energy, to food systems and do quantitative calculations on thermodynamics
- Describe the states of matter; describe the thermodynamic determinants of these states and factors influencing transition from one state to another and show how these factors are exploited in food systems
- Describe the colligative properties of solutions; do quantitative calculations on the colligative properties of solutions; relate colligative properties to food systems/processing
- Explain batch and fractional distillation; discuss steam distillation and distillation of non-ideal mixtures and do quantitative calculations on batch distillation processes
- Describe the basic principles of chemical kinetics; rate law, rate constant, reaction order and temperature effects; do quantitative calculations on chemical kinetics and relate these to food labeling and shelf life
- Discuss the phenomena of surface/interfacial tension/pressure and their measurement;
discuss surface absorption of solutes and relate this to food emulsion and foam formation and stabilization; do quantitative calculations on surface/interfacial tension/pressure.

- Carry out appropriate laboratory experiments, make accurate observations and write appropriate reports.

**Assessment:** Total Marks 100: End of Year Written Examination 80 marks; Continuous Assessment 20 marks (Laboratory, including reports: 3 x in-class tests).

**Compulsory Elements:** Adherence to the Attendance Regulation as specified in the UCC College Calendar: End of Year Written Examination; Continuous Assessment; attendance at laboratory practicals, submission of laboratory reports and completion of the in-class tests.

**Penalties (for late submission of Course/Project Work etc.):** Work which is submitted late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

**Pass Standard and any Special Requirements for Passing Module:** 40% In addition, students must demonstrate a minimum satisfactory performance in the continuous assessment component of the module by attending the practical sessions at the time and date scheduled, undertaking the practical and submitting a practical report for at least 2 of the 3 practical sessions and by completing at least 2 of the 3 in-class tests at the time and date scheduled. Students not meeting this requirement will be debarred from the examination in the module and from the Autumn Supplemental Examination in the module. A student will be warned when s/he has failed to fulfill the above criteria for each practical session missed, report not submitted or in-class test not completed.

**End of Year Written Examination Profile:** 1 x 1½ hr(s) paper(s).

**Requirements for Supplemental Examination:** 1 x 1½ hr(s) paper(s) to be taken in Autumn. A pass Continuous Assessment is carried forward. Failed elements of Continuous Assessment (In-class tests) must be repeated.

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**FS2004 Topics in Food Quality and Legislation A**

**Credit Weighting:** 5

**Teaching Period(s):** Teaching Periods 1 and 2.

**No. of Students:** Max 60.

**Pre-requisite(s):** None

**Co-requisite(s):** None

**Teaching Methods:** 24 x 1 hr(s) Lectures.

**Module Co-ordinator:** Dr Joseph Kerry, School of Food and Nutritional Sciences.

**Lecturer(s):** Staff, School of Food and Nutritional Sciences.

**Module Objective:** To provide students with an overview of key aspects of quality systems, statistical quality control and legislation in the food industry.

**Module Content:** Good laboratory practice (GLP). Statistical quality control including use of control charts and sampling procedures. Quality systems standards including ISO. Auditing. Good Manufacturing Practice and HACCP. Principles of cleaning and sterilisation. Food legislation in Ireland and EU. Codex Alimentarius.
Learning Outcomes: On successful completion of this module, students should be able to:
· Explain the objectives of food legislation and the approach used in Ireland to the
  enactment and enforcement of food legislation.
· Outline the approach in the European Union to the regulation of the food sector and
declare the role of the Codex Alimentarius Commission in harmonising non-tariff barriers
to food trade worldwide.
· Explain the meaning of terms relevant to food analysis data: accuracy, precision,
  repeatability, reproducibility, error, bias, specificity, sensitivity, limit of detection, limit of
  quantitation.
· Describe the background, the key principles including calibration and use of reference
  materials, and the accreditation process for Good Laboratory Practice (GLP).
· Outline the benefits, the use and implementation of Control Charts in a manufacturing
  facility including indications for action when using the charts and outline the key principles
  of random, variable and attribute sampling plans.
· Explain the meaning of terms relevant to food quality and safety: hazards, contamination,
adulteration, mix-up, auditing, quality systems, generally regarded as safe (GRAS).
· Describe the background, the practice distinctions and the ten substantive areas of Good
  Manufacturing Practice (GMP).
· Outline the basic elements of hazard analysis critical control points (HACCP) and the
  general approach to implementing a HACCP plan within a food company.
· Describe the background, the various systems used and the practical implementation of
  the International Standards Organisation (ISO) quality system within the food
  manufacturing industry.

Assessment: Total Marks 100: End of Year Written Examination 80 marks (Written
questions); Continuous Assessment 20 marks (Library project).

Compulsory Elements: End of Year Written Examination; Continuous Assessment.
Library projects must be submitted on the date specified by the School for inclusion in final
grade.

Penalties (for late submission of Course/Project Work etc.): Work which is submitted
late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

Pass Standard and any Special Requirements for Passing Module: 40%.

End of Year Written Examination Profile: 1 x 1½ hr(s) paper(s).

Requirements for Supplemental Examination: 1 x 1½ hr(s) paper(s) to be taken in
Autumn. The mark for Continuous Assessment is carried forward.
FS3001 Work Placement

Credit Weighting: 10

Teaching Period(s):
No. of Students: -

Pre-requisite(s): None

Co-requisite(s): None

Teaching Methods: Placements (24-week Work Placement).

Module Co-ordinator: Dr Eileen O’Neill, School of Food and Nutritional Sciences.

Lecturer(s): Staff, School of Food and Nutritional Sciences.

Module Objective: To provide an opportunity for students to gain relevant work experience in a commercial environment.

Module Content: Students will be placed in an industrial or other relevant work environment for 24 weeks, and will be expected to make a significant contribution to a relevant project under the supervision of industrial and UCC personnel. Students are obliged to actively participate in the Work Placement Programme and to attend scheduled interviews. Students are required to prepare a final report on their placement, and make a presentation on their work.

Learning Outcomes: On successful completion of this module, students should be able to:
· Identify, relate and apply the content of academic courses to specific work practices and make a worthwhile contribution in the workplace
· Differentiate between job roles in the workplace to aid career choice
· Reflect on the experiential learning and personal development that takes place during placement and summarise in a Reflective log and Final Written Report
· Display people related skills - communications, influencing, interpersonal, team working, listening and customer care
· Display conceptual skills - researching, collecting and organising information, problem solving, planning and organising, learning to learn, innovation and creativity, systems thinking and self-reliance
· Demonstrate professional behaviour and accept the need for confidentiality and ethical practice in the workplace
· Show commercial awareness through knowledge of basic business operations
· Where appropriate, operate the required range of equipment and perform the required role in an efficient and safe way.

Assessment: Total Marks 200: Continuous Assessment 200 marks (student's weekly learning log, academic mentor's visit, student's final written report, employer's assessment report, oral presentation).

Compulsory Elements: Continuous Assessment.

Penalties (for late submission of Course/Project Work etc.): Work which is submitted late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

Pass Standard and any Special Requirements for Passing Module: A Pass Judgement.

End of Year Written Examination Profile: No End of Year Written Examination.

Requirements for Supplemental Examination: No Supplemental Examination. Students
failing this module must repeat it after the Final Degree Examination and must pass in order to graduate.

FS3002 Chemistry of Food Proteins

Credit Weighting: 5

Teaching Period(s): Teaching Period 1.

No. of Students: Max 80.

Pre-requisite(s): FS2002

Co-requisite(s): None

Teaching Methods: 24 x 1hr(s) Lectures; 6 x 3hr(s) Practicals (Laboratory Sessions).

Module Co-ordinator: Dr Eileen O’Neill, School of Food and Nutritional Sciences.

Lecturer(s): Staff, School of Food and Nutritional Sciences.

Module Objective: To discuss comprehensively the chemical and physical properties of food proteins.

Module Content: Chemistry of food protein systems (milk, meat, fish, eggs, cereals, legumes, unconventional protein sources). Preparation and characterisation of food proteins. Protein determination in foods. Introduction to the properties of enzymes and enzyme systems. A set of practicals will support lecture material.

Learning Outcomes: On successful completion of this module, students should be able to:
· State the composition of milks of various species; describe the chemistry of the protein system in milk and the salt (mineral) system in milk and its association with the protein system; contrast human and bovine milks; describe the mechanisms of acid and rennet induced coagulation of milk proteins; discuss the heat stability of milk and the thermal denaturation of milk proteins and its consequences
· State the composition of the avian egg and its fractions; diagrammatically illustrate the structure of the avian egg; discuss indices of ageing of an egg; describe specific biochemical properties of the individual egg white proteins
· Outline the structure, function and location of proteins in skeletal muscle and the main events involved in muscle contraction of post-mortem glycolysis
· Discuss the properties of cereal proteins
· Describe the main factors which affect enzyme activity and explain what it meant by indigenous, exogenous and endogenous enzymes, giving examples of each
· Specify raw materials from which dry food protein enriched ingredients are recovered and detail some general aspects considered during their recovery; discuss specifications and international standards for dry food protein enriched ingredients
· Describe how the physico-chemical properties of milk constituents are exploited in industrial scale processes used to recover dry milk protein enriched ingredients, including fractionated milk protein enriched ingredients, milk protein hydrolysates and bioactive milk peptides
· Describe how the physico-chemical properties of eggs, wheat, soya bean and legumes are exploited in industrial scale processes used to recover dry egg, wheat, soya and legume protein-enriched ingredients
· Discuss methods of protein recovery/isolation and characterisation on a laboratory scale
and present some case studies on protein recovery/isolation.

**Assessment:** Total Marks 100: End of Year Written Examination 80 marks; Continuous Assessment 20 marks (Laboratory attendance; Laboratory reports; Laboratory test).

**Compulsory Elements:** Adherence to the Attendance Regulation as specified in the UCC College Calendar: End of Year Written Examination; Continuous Assessment; attendance at laboratory practicals, submission of laboratory reports and completion of the laboratory test.

**Penalties (for late submission of Course/Project Work etc.):** Work which is submitted late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

**Pass Standard and any Special Requirements for Passing Module:** 40% In addition, students must demonstrate a minimum satisfactory performance in the continuous assessment component of the module by attending the laboratory practical sessions at the time and date scheduled, undertaking the practical and submitting a practical report for at least 4 of the 6 practical sessions. Students not meeting this requirement will be debarred from the examination in the module and from the Autumn Supplemental Examination in the module. A student will be warned when s/he has failed to fulfill the above criteria for each practical session missed or report not submitted.

**End of Year Written Examination Profile:** 1 x 1½ hr(s) paper(s) to be taken in Spring.

**Requirements for Supplemental Examination:** 1 x 1½ hr(s) paper(s) (A pass Continuous Assessment mark is carried forward. Students who fail Continuous Assessment will be given the opportunity to repeat the Laboratory test component of Continuous Assessment.) to be taken in Autumn.

### FS3003 Chemistry and Technology of Oils and Fats

**Credit Weighting:** 5

**Teaching Period(s):** Teaching Period 1.

**No. of Students:** Max 80.

**Pre-requisite(s):** FS2002

**Co-requisite(s):** None

**Teaching Methods:** 24 x 1hr(s) Lectures; 4 x 3hr(s) Practicals (Laboratory Sessions).

**Module Co-ordinator:** Dr Thomas O'Connor, School of Food and Nutritional Sciences.

**Lecturer(s):** Staff, School of Food and Nutritional Sciences.

**Module Objective:** To provide a detailed overview of key aspects of the chemistry and technology of food fats.

**Module Content:** Lipid spoilage including oxidative and hydrolytic rancidity. Physical properties of food fats with particular emphasis on melting behaviour. Lipid emulsions. Lipid systems of the major food groups. Extraction and purification of fats from animal and vegetable sources. Fat substitutes. Margarines, spreads and shortenings. Butter manufacture and properties.

**Learning Outcomes:** On successful completion of this module, students should be able to:
- Describe the process for manufacture of butter and low- and full-fat dairy-based spreads
· Explain how changing process variables and ingredients used to influence the characteristics of the above products
· Explain the importance of flow-behaviour of fats and oils to their use as spreads and food ingredients
· Determine crystalline forms of fats and oils and use thermal processes to achieve desired and stable crystalline forms of lipids including cocoa butter in chocolate
· Explain typical industrial processes used to recover and refine edible fats and oils
· Describe processes to extract fats and oils from plant and animal sources and manipulate properties of fats and oils using fractionation, hydrogenation and interesterification
· Outline the chemical reactions involved in the oxidative deterioration of food lipids, the key factors that influence the rate of these chemical reactions and how lipid oxidation may be measured in food products
· Describe the lipid systems of milk, eggs, meat, fish and the major oilseeds
· Carry out laboratory procedures relevant to the academic content of the module.

Assessment: Total Marks 100: End of Year Written Examination 90 marks; Continuous Assessment 10 marks (Laboratory notebook and assessed performance).

Compulsory Elements: End of Year Written Examination; Continuous Assessment.

Penalties (for late submission of Course/Project Work etc.): Work which is submitted late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

Pass Standard and any Special Requirements for Passing Module: 40%.

End of Year Written Examination Profile: 1 x 1½ hr(s) paper(s) to be taken in Spring.

Requirements for Supplemental Examination: 1 x 1½ hr(s) paper(s) to be taken in Autumn. The mark for Continuous Assessment is carried forward.

FS3004 Sensory Analysis, Flavour and Colour

Credit Weighting: 5

Teaching Period(s): Teaching Period 2.

No. of Students: Max 80.

Pre-requisite(s): None

Co-requisite(s): None

Teaching Methods: 24 x 1hr(s) Lectures; 3 x 3hr(s) Practicals.

Module Co-ordinator: Professor Paul McSweeney, School of Food and Nutritional Sciences.

Lecturer(s): Staff, School of Food and Nutritional Sciences.

Module Objective: To provide a comprehensive overview of the interaction between food flavour, colour and sensory perception.

Module Content: Colour pigments in foods; artificial colours; measurement of colour using instruments; colour perception. Non-volatile and volatile flavour composition of foods; measurement of flavour using instruments; flavour perception. Rheology, structure and texture perception. Interactions between colour, flavour and texture.

Learning Outcomes: On successful completion of this module, students should be able to:
· Define sensory analysis as the scientific measurement of the attributes of a product perceived by the senses (sight, sound, smell, taste, touch); discuss the problems associated with informal sensory sessions and explain why formalized sensory methodology should be used.

· Explain how we use our senses to assess sensory attributes; describe how, and in what order, appearance, odour/aroma/fragrance (orthonasal), consistency/texture and flavour (retro-nasal aroma and taste) attributes are perceived; describe the taste system and the olfactory systems in detail; recognise the inherent variability in human perception and judgment, resulting from differences in sensitivity between people.

· Distinguish between the three main areas of sensory methodology (discrimination tests; descriptive analysis; preference or hedonics tests); describe procedures used in design of sensory experiments and in collection and analysis of sensory data; apply principles of good practice when conducting laboratory experiments for the sensory evaluation of foods.

· Describe how sensory methods are used to (i) compare competitive products, (ii) interpret consumer-directed feedback and guide new product development, (iii) assure quality, and (iv) track changes in appearance, flavour and texture of foods over their shelf life.

· Use magnitude estimation to obtain quantitative correlations between objective and perceived intensities of sensory stimuli, and describe how it has been applied in relating the rheology of thickened and gelled samples to perceived texture and flavour/taste release.

· Describe in detail the CIE, Hunter and Munsell colour measurement systems; draw a line diagram of a tristimulus colorimeter and label its component parts.

· Describe the chemical properties, stability and changes that occur during processing of chlorophyll, myoglobin, anthocyanins, flavones, flavanols, betalaines, carotenoids and apocarotenoid pigments and cochineal; discuss the chemistry and limitations of artificial food colourants.

· Describe the principal chemical steps in caramelization, enzymatic and non-enzymatic (Maillard) browning and be able to apply this knowledge to the control of browning reactions in foods.

**Assessment:** Total Marks 100: End of Year Written Examination 90 marks; Continuous Assessment 10 marks.

**Compulsory Elements:** End of Year Written Examination; Continuous Assessment.

**Penalties (for late submission of Course/Project Work etc.):** Work which is submitted late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

**Pass Standard and any Special Requirements for Passing Module:** 40%.

**End of Year Written Examination Profile:** 1 x 1½ hr(s) paper(s) to be taken in Spring.

**Requirements for Supplemental Examination:** 1 x 1½ hr(s) paper(s) to be taken in Autumn. The mark for Continuous Assessment is carried forward.

**FS3005 Macromolecules and Rheology**

**Credit Weighting:** 5

**Teaching Period(s):** Teaching Period 1.

**No. of Students:** Max 80.

**Pre-requisite(s):** FS2002

**Co-requisite(s):** None
**Teaching Methods:** 24 x 1 hr(s) Lectures; 5 x 3 hr(s) Practicals; Tutorials.

**Module Co-ordinator:** Dr Eileen O’Neill, School of Food and Nutritional Sciences.

**Lecturer(s):** Staff, School of Food and Nutritional Sciences.

**Module Objective:** To study the role of macromolecules in creation and control of the physical structure and perceived texture of high-moisture foods.

**Module Content:** Structure and conformation of food polysaccharides. Hydrolysis products; saccharide analysis. Use of biopolymers as thickeners, stabilisers and gelling agents. Application of physical techniques to food biopolymers. Rheological characterisation of texture.

**Learning Outcomes:** On successful completion of this module, students should be able to:
- Describe and explain appropriate rheological terms and concepts.
- Sketch the following: typical mechanical spectra for dilute solutions of biopolymers, entangled coils, gels, 'weak gels' and critically-crosslinked networks; creep-recovery curves for Hookean solids, Newtonian liquids and viscoelastic materials; typical compression curves for gels and spreads.
- Describe and explain the concentration-dependence of 'zero shear' viscosity and shear-rate dependence of viscosity for solutions of entangled polysaccharide coils and the variation of intrinsic viscosity of polyelectrolytes with ionic strength.
- Write the following equations: power law; Bingham, Herschel-Bulkley and Casson; Einstein and Mark-Houwink; Cross equation and simplified form applicable to solutions of entangled polysaccharide coils.
- Describe the structure, sources, production and food applications of a range of biopolymers and relate the ordered structure of each biopolymer chain to primary sequence and geometry of residue linkages. Apply the Second Law of Thermodynamics to association of hydrophilic and hydrophobic sequences.
- Describe and explain the gelatinisation, pasting, gelation and retrogradation of starch and the mechanism of gel formation by carrageenans, furcellaran, agars, agarose, gellan, alginates, pectins, gelatin, globular proteins, methylcellulose, HPMC and 'synergistic' mixtures of selected biopolymers.
- Outline the biosynthesis of alginates, carrageenans and agars and the implications for practical applications in food.
- Explain the principles of the following physical techniques and describe their applications to food macromolecules: X-ray fibre diffraction, optical rotation, circular dichroism, differential scanning calorimetry, NMR and light scattering.
- Carry out laboratory procedures relevant to the academic content of the module.

**Assessment:** Total Marks 100: End of Year Written Examination 85 marks; Continuous Assessment 15 marks (Laboratory notebook and assessed performance).

**Compulsory Elements:** End of Year Written Examination; Continuous Assessment.

**Penalties (for late submission of Course/Project Work etc.):** Work which is submitted late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

**Pass Standard and any Special Requirements for Passing Module:** 40%.

**End of Year Written Examination Profile:** 1 x 1½ hr(s) paper(s) to be taken in Spring.

**Requirements for Supplemental Examination:** 1 x 1½ hr(s) paper(s) to be taken in Autumn. The mark for Continuous Assessment is carried forward.
FS3006 Food Processing and Preservation

Credit Weighting: 10

Teaching Period(s): Teaching Periods 1 and 2.

No. of Students: Max 80.

Pre-requisite(s): PE2006, PE2007

Co-requisite(s): None

Teaching Methods: 48 x 1hr(s) Lectures; 12 x 3hr(s) Practicals.

Module Co-ordinator: Prof Yrjo Roos, Faculty office-Food Sc & Technology.

Lecturer(s): Staff, School of Food and Nutritional Sciences.

Module Objective: To provide an understanding of food processing and preservation methods and principles, food material characteristics and requirements, and shelf-life control and stabilisation.

Module Content: Principles of food stability, preservation and safety; Traditional food preservation (salting, smoking, fermentation); Food components and ingredients (role of composition and ingredients, mechanical separation of components, homogenisation and emulsification, membrane processes, ion exchange, distillation, stability control); Freezing of foods and frozen foods stability; Conventional, dielectric and microwave heating; Thermal preservation (pasteurisation, UHT processing, sterilisation); Thermal kinetics (chemical, microbial, time-temperature indicators); Food concentration and dehydration; Food extrusion; Irradiation of foods; Minimal processing principles and novel food processing.

Learning Outcomes: On successful completion of this module, students should be able to:

· Describe the principle of operation of key heat-exchange systems used for food processing
· Explain factors which may lead food processors to select specific processes and equipment for individual food applications
· Describe the reasoning behind the use of chemical preservatives in food systems and the types which are permitted legally for use in food products within the EU
· Select appropriate processes and preservation methods for fresh foods and manufacture foods and food ingredients with enhanced shelf-life
· Describe cold storage and freezing processes in industrial food manufacturing
· Select appropriate methods and processes, including mechanical and membrane separation technologies, to separate food components based on their physical and chemical characteristics
· Use various dehydration techniques depending on their suitability for liquid and solid food dehydration
· Improve food safety using minimal processing methods
· Use food irradiation as an alternative for thermal processing and understand the impact of irradiation doses to changes in food components.

Assessment: Total Marks 200: End of Year Written Examination 180 marks; Continuous Assessment 20 marks (Practicals).

Compulsory Elements: End of Year Written Examination; Continuous Assessment.

Penalties (for late submission of Course/Project Work etc.): Work which is submitted late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

Pass Standard and any Special Requirements for Passing Module: 40%.
End of Year Written Examination Profile: 1 x 3 hr(s) paper(s) to be taken in Spring.

Requirements for Supplemental Examination: 1 x 3 hr(s) paper(s) to be taken in Autumn. Marks attained in Continuous Assessment will be carried forward and combined with those achieved in the supplemental written examination.

FS3007 Dairy Product Technology

Credit Weighting: 5

Teaching Period(s): Teaching Periods 1 and 2.

No. of Students: Min 10, Max 80.

Pre-requisite(s): None

Co-requisite(s): None

Teaching Methods: 24 x 1hr(s) Lectures; 3 x 3hr(s) Practicals; Other (Factory Visits).

Module Co-ordinator: Professor Paul McSweeney, School of Food and Nutritional Sciences.

Lecturer(s): Staff, School of Food and Nutritional Sciences.

Module Objective: Detailed examination of liquid, dehydrated, fractionated and frozen dairy products.

Module Content: Primary milk production, overview of milk and dairy products. Technology and quality of liquid milks, cream, milk powders, casein and caseinates, whey processing, ice cream. Introduction to functional properties and applications of milk proteins.

Learning Outcomes: On successful completion of this module, students should be able to:
· Link the quality of dairy products to the quality of raw milk used in their production
· Explain the factors which influence the suitability of farm milk in Ireland for manufacture of dairy products
· Use commercial ingredients to produce dairy desserts including ice cream and explain functions of various ingredients in their formulation
· Explain principles of industrial ice cream manufacturing processes and manipulation of ice formation, crystal size and ice recrystallization
· Use state diagrams to explain stability and the kinetics of quality changes in frozen desserts
· Describe the principal stages in the manufacture and equipment used for the production of pasteurized liquid milk, cream, UHT milk, whey powders, lactose, whey protein concentrate, whey protein isolate, skim milk powder, whole milk powder, acid, rennet and lactic caseins, sodium caseinate and evaporated and condensed milks
· Explain the changes which occur during the production of these products
· Describe the principal quality attributes and defects of these products.

Assessment: Total Marks 100: End of Year Written Examination 80 marks; Continuous Assessment 20 marks (Laboratories).

Compulsory Elements: End of Year Written Examination; Continuous Assessment.

Penalties (for late submission of Course/Project Work etc.): Work which is submitted
late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

**Pass Standard and any Special Requirements for Passing Module:** 40%.

**End of Year Written Examination Profile:** 1 x 1½ hr(s) paper(s) to be taken in Spring.

**Requirements for Supplemental Examination:** 1 x 1½ hr(s) paper(s) to be taken in Autumn. The mark for Continuous Assessment is carried forward.

### FS3008 Fundamentals of Food Packaging

**Credit Weighting:** 5

**Teaching Period(s):** Teaching Period 1.

**No. of Students:** Max 80.

**Pre-requisite(s):** None

**Co-requisite(s):** None

**Teaching Methods:** 24 x 1hr(s) Lectures; 2 x 3hr(s) Practicals (Laboratory sessions).

**Module Co-ordinator:** Dr Joseph Kerry, School of Food and Nutritional Sciences.

**Lecturer(s):** Dr Joseph Kerry, School of Food and Nutritional Sciences.

**Module Objective:** To provide a thorough grounding in the fundamentals of food packaging.

**Module Content:** Introduction to food packaging, fundamentals of food packaging, packaging development, graphic design and printing of food packaging materials, manufacture and use of glass, metals, paperboard, corrugated paperboard, plastics and laminates in the food industry, closure systems, use of adhesives, MAP, CAP and vacuum packaging of foods, food packaging lines, warehousing-transport-distribution of packaged foods, package labelling, drafting of packaging specification sheets, QA/QC testing of packaging materials, legal requirements for food packaging, food packaging waste.

**Learning Outcomes:** On successful completion of this module, students should be able to:
- Outline the primary, secondary and tertiary role of packaging in the food industry
- Describe the information streams used to design packaging for food markets and the rules used in the development of the final food pack composition
- Describe the composition, manufacture, properties and uses of food packaging materials
- Explain the reasoning behind laminate manufacture, the processes used to manufacture laminates and commercial examples of laminates used with a wide range of food products
- Describe the information required to be present on food packs as determined by EU legislation
- Outline the basic elements required in order to print food pack graphics
- Describe the use of seals and closure systems in commercial food pack forms
- Explain the importance of food pack specification documents and describe in detail how a specification document would be drawn up.

**Assessment:** Total Marks 100: End of Year Written Examination 90 marks (Written examination); Continuous Assessment 10 marks (Practicals).

**Compulsory Elements:** End of Year Written Examination; Continuous Assessment.

**Penalties (for late submission of Course/Project Work etc.):** Work which is submitted
late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

Pass Standard and any Special Requirements for Passing Module: 40%.

End of Year Written Examination Profile: 1 x 1½ hr(s) paper(s) to be taken in Spring.

Requirements for Supplemental Examination: 1 x 1½ hr(s) paper(s) to be taken in Autumn. The mark for Continuous Assessment is carried forward.

FS4001 Research Project

Credit Weighting: 10

Teaching Period(s): Teaching Periods 1 and 2.

No. of Students: Max 45.

Pre-requisite(s): None

Co-requisite(s): None

Teaching Methods: Directed Study (Independent Supervised Research; Seminars and Practicals in Communications Skills).

Module Co-ordinator: Dr Eileen O'Neill, School of Food and Nutritional Sciences.

Lecturer(s): Staff, School of Food and Nutritional Sciences.

Module Objective: To apply research techniques and integrate knowledge in identifying, describing, analysing and solving problems within the field of Food Science. To enhance communications skills.

Module Content: Laboratory based research project on a Food Science topic under the supervision of a relevant staff member. Students will be expected to prepare a detailed report on their experimental work in conformance with guidelines that will be provided.

Learning Outcomes: On successful completion of this module, students should be able to:
- Use experimental techniques relevant to their assigned project
- Design and plan informative investigations by these techniques
- Interpret the results obtained
- Produce a well-structured account of their experimental findings
- Write a critical review of published work relevant to the topic of their research.

Assessment: Total Marks 200: Continuous Assessment 200 marks (Laboratory Performance; Report, according to guidelines provided).

Compulsory Elements: Continuous Assessment.

Penalties (for late submission of Course/Project Work etc.): Where work is submitted up to and including 7 days late, 10% of the total marks available shall be deducted from the mark achieved. Where work is submitted up to and including 14 days late, 20% of the total marks available shall be deducted from the mark achieved. Work submitted 15 days late or more shall be assigned a mark of zero.

Pass Standard and any Special Requirements for Passing Module: 40%.

End of Year Written Examination Profile: No End of Year Written Examination.

Requirements for Supplemental Examination: No Supplemental Examination.
FS4002 Team Product Development Project

Credit Weighting: 10

Teaching Period(s): Teaching Periods 1 and 2.

No. of Students: Max 40.

Pre-requisite(s): None

Co-requisite(s): None

Teaching Methods: Other (Research Project (typically product or process development) carried out by teams comprising 2-4 students, under the supervision of staff; seminars and practicals in communications skills).

Module Co-ordinator: Prof Alan Kelly, School of Graduate Studies office.

Lecturer(s): Staff, School of Food and Nutritional Sciences.

Module Objective: To provide students with scientific project experience applicable to all aspects of development of a food product or process; to enhance communication skills.

Module Content: Laboratory and processing hall-based research project on a relevant area of food science and technology under the supervision of an appropriate staff member. Students will prepare a detailed report on their experimental work and findings. Students will also attend a series of seminars and workshops designed to enhance communications skills.

Learning Outcomes: On successful completion of this module, students should be able to:
- Apply principles of new product development to the practical development of an innovative food product
- Undertake a scientific research project in a systematic way in a small team
- Produce an innovative food product at laboratory and pilot scale
- Apply techniques such as chemical, physical, microbiological and sensory analysis, including shelf-life determination to a new food product, and develop a HACCP plan for this
- Produce a comprehensive project report including a review of relevant literature
- Understand how the fundamental rules of food packaging are applied in the development of new food products.

Assessment: Total Marks 200: Continuous Assessment 200 marks (preparation of report, based on review of literature and details of process or product development and experimental work).

Compulsory Elements: Continuous Assessment. Participation in project and submission of required reports.

Penalties (for late submission of Course/Project Work etc.): Where work is submitted up to and including 7 days late, 10% of the total marks available shall be deducted from the mark achieved. Where work is submitted up to and including 14 days late, 20% of the total marks available shall be deducted from the mark achieved. Work submitted 15 days late or more shall be assigned a mark of zero.

Pass Standard and any Special Requirements for Passing Module: 40%.

End of Year Written Examination Profile: No End of Year Written Examination.
Requirements for Supplemental Examination: No Supplemental Examination.

FS4003 Advanced Analytical Methods

Credit Weighting: 5

Teaching Period(s): Teaching Periods 1 and 2.

No. of Students: Min 5.

Pre-requisite(s): None

Co-requisite(s): None

Teaching Methods: 10 x 4hr(s) Practical.

Module Co-ordinator: Dr Eileen O’Neill, School of Food and Nutritional Sciences.

Lecturer(s): Staff, School of Food and Nutritional Sciences.

Module Objective: To teach advanced food analysis methods.

Module Content: This module will stress the theoretical aspects and practical applications of a number of analytical techniques used in the food industry and in food research laboratories. Students will have the opportunity to use a number of analytical techniques including HPLC, GC, electrophoresis, spectrophotometry, fluorimetry, differential scanning calorimetry, dynamic and static rheometry, viscometry, enzyme and immunochemical analyses.

Learning Outcomes: On successful completion of this module, students should be able to:
· Outline the principles underlying the use of rheology, spectroscopy, differential scanning calorimetry, electrophoresis, chromatography and sensory science in food research.
· Describe the instrumentation involved in rheology, spectroscopy, differential scanning calorimetry, electrophoresis and chromatography and interpret data produced from these analytical units.

Assessment: Total Marks 100: Continuous Assessment 100 marks (In-class Tests 50 marks; Laboratory Reports and Performance 50 marks).

Compulsory Elements: Continuous Assessment.

Penalties (for late submission of Course/Project Work etc.): Where work is submitted up to and including 7 days late, 10% of the total marks available shall be deducted from the mark achieved. Where work is submitted up to and including 14 days late, 20% of the total marks available shall be deducted from the mark achieved. Work submitted 15 days late or more shall be assigned a mark of zero.

Pass Standard and any Special Requirements for Passing Module: 40% Students must demonstrate a minimum satisfactory performance in the practical component of the module by attending the practical sessions at the time and date scheduled, undertaking the practical and submitting a practical report for at least 80% of the practical sessions. Students not meeting this requirement will be debarred from the in-class tests in the module and from the Autumn Supplemental Examination in the module. A student will be warned when s/he has failed to fulfill the above criteria for more than 10% of practical sessions.
FS4006 Cereals and Related Beverages

Credit Weighting: 5
Teaching Period(s): Teaching Period 1.
No. of Students: Min 5 (-).
Pre-requisite(s): FS3002 and FS3003
Co-requisite(s): None
Teaching Methods: 24 x 1 hr(s) Lectures; 6 x 4 hr(s) Practicals (and industrial visits).
Module Co-ordinator: Prof Elke Arendt, School of Food and Nutritional Sciences.
Lecturer(s): Staff, School of Food and Nutritional Sciences.

Module Objective: To provide understanding of chemistry, microbiology and technology of cereals, cereal products as well as a wide range of beverages based on cereals.

Module Content: Cereal and cereal products: structure, starch proteins, minor constituents, storage, milling, yeast leavened products, dough additives, biscuits, breakfast cereals, pasta, frozen doughs and bakery products.
Beverages: Production of fermented and other beverages such as beer and distilled beverages based on cereals. Raw materials, equipment quality and legislation of these products/processes will be discussed.

Learning Outcomes: On successful completion of this module, students should be able to:
- Outline the quality characteristics of barley varieties needed to produce good quality malt
- Apply your knowledge of the basic principals of the malting to the design of malting processes, taking specific raw-material criteria into account
- Apply your knowledge of the brewing process to work efficiently in the brewing industry
- Outline the quality characteristics of wheat varieties needed for the development of various types of cereal products
- Apply your knowledge of a wide range of cereal processing techniques to work efficiently in the food industry.
- Apply your knowledge of the design of specialty cereal-based products such as part-baked products, frozen breads and gluten-free products to develop or design new products for the food industry.

Assessment: Total Marks 100: End of Year Written Examination 70 marks (Written examination); Continuous Assessment 30 marks (Laboratory practical reports).
Compulsory Elements: End of Year Written Examination; Continuous Assessment. Attendance at Laboratory Practicals.

Penalties (for late submission of Course/Project Work etc.): Work which is submitted late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).
Pass Standard and any Special Requirements for Passing Module: 40%.
FS4010 Food Shelf-Life Control

Credit Weighting: 5

Teaching Period(s): Teaching Period 1.

No. of Students: Max 80.

Pre-requisite(s): FS2003 (or equivalent), FS3006

Co-requisite(s): None

Teaching Methods: 24 x 1hr(s) Lectures; Other.

Module Co-ordinator: Prof Yrjo Roos, Faculty office-Food Sc & Technology.

Lecturer(s): Prof Yrjo Roos, Faculty office-Food Sc & Technology.

Module Objective: To provide understanding of physical chemistry concepts in the control of food properties and stability, and kinetics of chemical, enzymatic and microbial changes.


Learning Outcomes: On successful completion of this module, students should be able to:
· Identify foods as equilibrium and nonequilibrium systems and control driving forces affecting food stability and shelf life.
· Use composition of foods to predict their physicochemical properties and changes in processing and storage.
· Explain time-dependent characteristics of food materials.
· Explain factors controlling rates of chemical, enzymatic, physical and microbial changes in foods.
· Describe factors affecting diffusion and flow in foods and explain how food processes and composition can be used to maximize quality.
· Use phase diagrams, state diagrams and shelf-life plots in food processing and design to predict and enhance food safety and stability.
· Apply mathematical models to relate water content, temperature and other variables to predict reaction rates and microbial growth in foods.

Assessment: Total Marks 100: End of Year Written Examination 100 marks.

Compulsory Elements: End of Year Written Examination.

Penalties (for late submission of Course/Project Work etc.): None.

Pass Standard and any Special Requirements for Passing Module: 40%.

End of Year Written Examination Profile: 1 x 1½ hr(s) paper(s).
Requirements for Supplemental Examination: 1 x 1½ hr(s) paper(s) to be taken in Autumn.

**FS4011 Advanced Food Packaging**

**Credit Weighting:** 5

**Teaching Period(s):** Teaching Period 2.

**No. of Students:** Min 5.

**Pre-requisite(s):** FS3008

**Co-requisite(s):** None

**Teaching Methods:** 24 x 1hr(s) Lectures.

**Module Co-ordinator:** Dr Joseph Kerry, School of Food and Nutritional Sciences.

**Lecturer(s):** Dr Joseph Kerry, School of Food and Nutritional Sciences.

**Module Objective:** To provide a more advanced programme of lectures relating to current, topical and expanding research interest areas within the field of food packaging science.

**Module Content:** Active food packaging; Advanced testing of packaging materials; Identification methods used for plastic food packaging materials; Shaping and manufacturing processes used for the production of moulded plastic food containers; Edible films and coatings used in the food packaging industry; Use of smart packaging by the food industry; Use of sensor technology within the food packaging industry; Consumer attitudes to food packaging materials; Packaging material residues in food products; Advanced commercial aspects of food packaging; Advanced food packaging systems used for all food categories.

**Learning Outcomes:** On successful completion of this module, students should be able to:

- Outline all food product categories and describe in detail how and why specific food packaging materials should be used to pack these products.
- Describe the use of smart packaging technologies for use with food products.
- Explain the differences between edible and biodegradable packaging materials and describe the types of packaging materials in existence today and their commercial uses.
- Outline the commercial forms of printing technologies used and describe how these technologies are applied to produce the necessary graphics which appear on all retail food packs.
- Describe the various engineering approaches used to manufacture plastics for use within the food industry.
- Outline all of the considerations which need to be addressed when setting up a food production and packaging line.
- Describe machinery and production processes used on the filling and packaging lines used for liquid products.
- Describe machinery and production processes used on the filling and packaging lines used for solid products.

**Assessment:** Total Marks 100: End of Year Written Examination 100 marks (Written examination).

**Compulsory Elements:** End of Year Written Examination.
Penalties (for late submission of Course/Project Work etc.): None.
Pass Standard and any Special Requirements for Passing Module: 40%.
End of Year Written Examination Profile: 1 x 1½ hr(s) paper(s).
Requirements for Supplemental Examination: 1 x 1½ hr(s) paper(s) to be taken in Autumn.

FS4014 Food Product Development and Innovation

Credit Weighting: 5
Teaching Period(s): Teaching Period 1.
No. of Students: Min 5 (-).
Pre-requisite(s): None
Co-requisite(s): None
Teaching Methods: 24 x 1hr(s) Lectures; Other.
Module Co-ordinator: Prof Alan Kelly, School of Graduate Studies office.
Lecturer(s): Prof Alan Kelly, School of Graduate Studies office; Dr Joseph Bogue, School of Food Business and Development.
Module Objective: To provide an understanding of technological and scientific aspects of new product development (NPD) in the food sector, as well as the factors influencing food choice, the implications of this for the new food product development process, and methods to develop more market-oriented food products
Module Content: The scientific and technological principles underpinning NPD will be explained, including stages of the NPD process and activities, NPD success factors, new product design, food innovation case studies, market-oriented NPD methodologies, organisation for successful NPD, integration of market and sensory analysis, marketing of novel foods, food safety and shelf-life aspects of NPD and use of novel food ingredients and novel processing technologies. In parallel, students will learn about the various tools and methodologies utilised to evaluate consumer attitudes, preferences and market acceptance factors and the implications for NPD strategies. Factors that influence NPD success will be identified and innovation case studies will highlight best practice in terms of the integration of technological and marketing approaches to NPD. Topics addressed will include food choice models and new product trends.
Learning Outcomes: On successful completion of this module, students should be able to:
· Identify the key new product development (NPD) success factors across sectors worldwide;
· Design an NPD process for a new food product and identify the different commercialisation strategies that food firms utilise in competitive markets;
· Integrate disciplines such as sensory analysis, process design, ingredient selection and statistical analysis into a coherent strategy for the technological development of new food products;
· Critically analyse the role of knowledge management and effective marketing strategies in new food product success.
Assessment: Total Marks 100: End of Year Written Examination 90 marks; Continuous
Assessment 10 marks (Student Assignments).

**Compulsory Elements:** End of Year Written Examination; Continuous Assessment.

**Penalties (for late submission of Course/Project Work etc.):** Where work is submitted up to and including 7 days late, 5% of the total marks available shall be deducted from the mark achieved. Where work is submitted up to and including 14 days late, 10% of the total marks available shall be deducted from the mark achieved. Work submitted 15 days late or more shall be assigned a mark of zero.

**Pass Standard and any Special Requirements for Passing Module:** 40%.

**End of Year Written Examination Profile:** 1 x 1½ hr(s) paper(s).

**Requirements for Supplemental Examination:** 1 x 1½ hr(s) paper(s) to be taken in Autumn. The mark for Continuous Assessment is carried forward.

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**FS4020 Dairy Science and Technology**

**Credit Weighting:** 5

**Teaching Period(s):** Teaching Period 1.

**No. of Students:** Min 0, Max 0.

**Pre-requisite(s):** None

**Co-requisite(s):** None

**Teaching Methods:** 24 x 1 hr(s) Lectures; 3 x 4 hr(s) Practicals (and industrial visits).

**Module Co-ordinator:** Professor Paul McSweeney, School of Food and Nutritional Sciences.

**Lecturer(s):** Staff, School of Food and Nutritional Sciences.

**Module Objective:** To provide an understanding of chemistry, microbiology and technology of fermented dairy products and other topics related to dairy foods.

**Module Content:** Discussion of lactose, heat and ethanol stability, acid and rennet coagulation of milk, syneresis, dairy starter cultures, bacteriophage and the technology of acid and rennet curd cheeses, yogurt, processed cheese, enzyme modified cheese, analogue cheese.

**Learning Outcomes:** On successful completion of this module, students should be able to:

- Describe the influence of processing steps and ingredient selection on the characteristics of processed cheese and yoghurt.
- Describe in detail the process by which milk gels in the presence of acid and ethanol and outline what factors affect gel structure.
- Explain in detail the rennet coagulation of milk and the factors which affect this process.
- Describe the factors which affect the syneresis of rennet-induced milk gels.
- Outline the principal steps usual in the preparation of milk for cheesemaking and describe the effects of each step on the finished product.
- Describe the physicochemical and other changes which occur to cheesecurd on cheddaring and during the cooking-stretching step of the manufacture of pasta filata varieties.
- Explain the functions of NaCl in cheese and the factors which affect salt uptake.
- Explain the principal microbiological and biochemical events which occur in cheese
during ripening.

Assessment: Total Marks 100: End of Year Written Examination 90 marks; Continuous Assessment 10 marks (one 2000-3000 word report on practicals).

Compulsory Elements: End of Year Written Examination; Continuous Assessment.

Penalties (for late submission of Course/Project Work etc.): Work which is submitted late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

Pass Standard and any Special Requirements for Passing Module: 40%.

End of Year Written Examination Profile: 1 x 1½ hr(s) paper(s).

Requirements for Supplemental Examination: 1 x 1½ hr(s) paper(s) to be taken in Autumn. Marks in passed element(s) of Continuous Assessment are carried forward, Failed element(s) of Continuous Assessment must be repeated.

FS4021 Meat Science and Technology

Credit Weighting: 5

Teaching Period(s): Teaching Period 1.

No. of Students: Min 0, Max 70.

Pre-requisite(s): None

Co-requisite(s): None

Teaching Methods: 24 x 1hr(s) Lectures; 6 x 4hr(s) Practicals (and industrial visits).

Module Co-ordinator: Dr Eileen O'Neill, School of Food and Nutritional Sciences.

Lecturer(s): Dr Eileen O'Neill, School of Food and Nutritional Sciences; Dr Joseph Kerry, School of Food and Nutritional Sciences.

Module Objective: To provide understanding of the chemistry, technology and microbiology of muscle-based foods


Learning Outcomes: On successful completion of this module, students should be able to:

· Outline the major pre- and post-slaughter factors which influence the quality of meat.
· Describe the major steps involved in the slaughter of cattle, pigs and poultry.
· Identify the major factors that influence the colour stability and water holding capacity of meat.
· Describe the type, role and function of muscle-based proteins and their importance in the successful manufacture of processed products.
· Identify the categories of ingredients used in the manufacture of processed meat products, describing in detail, the functional roles performed by these substances.
· Explain the sequential steps involved in the manufacture of reformed and restructured meat products and describe the science underpinning each step in these processes.
· Describe the role of micro-organisms in the manufacture of various fermented meat products.
· Carry out laboratory procedures relevant to the academic content of the module.

**Assessment:** Total Marks 100: End of Year Written Examination 85 marks; Continuous Assessment 15 marks (Laboratory practicals and industrial visits).

**Compulsory Elements:** End of Year Written Examination; Continuous Assessment.

**Penalties (for late submission of Course/Project Work etc.):** Work which is submitted late shall be assigned a mark of zero (or a Fail Judgement in the case of Pass/Fail modules).

**Pass Standard and any Special Requirements for Passing Module:** 40%.

**End of Year Written Examination Profile:** 1 x 1½ hr(s) paper(s).

**Requirements for Supplemental Examination:** 1 x 1½ hr(s) paper(s) to be taken in Autumn. The mark for Continuous Assessment is carried forward.

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**FS4022 Topics in Food Science**

**Credit Weighting:** 5

**Teaching Period(s):** Teaching Period 2.

**No. of Students:** Min 0, Max 70.

**Pre-requisite(s):** None

**Co-requisite(s):** None

**Teaching Methods:** 24 x 1hr(s) Lectures; Other.

**Module Co-ordinator:** Dr Thomas O'Connor, School of Food and Nutritional Sciences.

**Lecturer(s):** Dr Thomas O'Connor, School of Food and Nutritional Sciences; Professor Paul McSweeney, School of Food and Nutritional Sciences.

**Module Objective:** To provide understanding of selected topics relating to fruit and vegetables and dairy chemistry.

**Module Content:** Fruit and vegetable composition, structure, respiration and its control. Changes in fruit and vegetables during maturation and ripening. Processing and preservation of fruit and vegetables including effects on quality attributes. Spices and spice products. Selected topics in dairy chemistry.

**Learning Outcomes:** On successful completion of this module, students should be able to:
· Describe in detail the chemical composition, physical structure and the different patterns of respiration in fruit and vegetables and how respiration is modulated by refrigeration, controlled atmosphere storage and modified atmosphere packaging.
· Describe the changes that occur in fruit and vegetable composition, colour and texture during maturation and ripening.
· Outline in detail the preservation of fruit and vegetables by heat sterilization and by freezing and frozen storage, including the effects of these unit operations on quality attributes.
· Describe the importance and properties of spices and spice products in the food industry.
· Describe in detail the chemistry, uses, production and derivatives of lactose and the problems caused by this sugar in dairy processing and nutrition.
· Outline the components of the milk salts equilibrium and how this is affected by processing and other factors.
· Explain the relationship between heat stability of milk and pH, describe the changes which occur on heating milk and how processing influences the heat stability of milk.
· Describe the uses of exogenous enzymes (other than rennet) in dairy processing.
· Describe the principal indigenous biologically active constituents of milk.

Assessment: Total Marks 100: End of Year Written Examination 100 marks.

Compulsory Elements: End of Year Written Examination.

Penalties (for late submission of Course/Project Work etc.): None.

Pass Standard and any Special Requirements for Passing Module: 40%.

End of Year Written Examination Profile: 1 x 1½ hr(s) paper(s).

Requirements for Supplemental Examination: 1 x 1½ hr(s) paper(s) to be taken in Autumn.

FS4023 Food Bipolymer Ingredients and Mixtures
Credit Weighting: 5

Teaching Period(s): Teaching Period 2.

No. of Students: Max 60.

Pre-requisite(s): FS3002/FS3003/FS3005

Co-requisite(s): None

Teaching Methods: 24 x 1hr(s) Lectures; 3 x 1hr(s) Tutorials.

Module Co-ordinator: Dr Eileen O’Neill, School of Food and Nutritional Sciences.

Lecturer(s): Staff, School of Food and Nutritional Sciences.

Module Objective: To cover advanced aspects of the physico-chemical properties of food proteins and biopolymer mixtures of proteins and non-protein biopolymers exploited in food processing.


Learning Outcomes: On successful completion of this module, students should be able to:
· Describe functional attributes of proteins exploited in processing of specific food materials; discuss recovery of dry protein-enriched ingredient from food materials; state some general aspects considered during recovery of protein-enriched ingredient and on their use in reformulated food products
· Describe interaction of food proteins with water; discuss hydration, water binding, solubilization and the influence on these of intrinsic and extrinsic factors
· Discuss the viscous behaviour of protein solutions and the use of food proteins to influence/control viscosity in foods
· Discuss the use of proteins as gelling/structuring agents in foods; describe mechanisms of food protein gelation; describe microstructural and rheological properties of food protein gels; discuss effects of environmental factors on gelation and gel properties in foods
· Discuss the surface and interfacial behaviour of proteins; discuss the use of proteins as emulsifying and foaming agents in foods; describe processes used to form food emulsion and foam; discuss food emulsion and foam stability and destabilization processes
· Describe the interactions that can occur in mixtures of food biopolymers; explain the thermodynamic origin of phase separation, the construction of phase diagrams, and the factors promoting or inhibiting segregation; write the polymer blending laws developed for polymer composites and describe how their application can be extended to biphasic gels.

**Assessment:** Total Marks 100: End of Year Written Examination 100 marks.

**Compulsory Elements:** End of Year Written Examination.

**Pass Standard and any Special Requirements for Passing Module:** 40%.

**End of Year Written Examination Profile:** 1 x 1½ hr(s) paper(s).

**Requirements for Supplemental Examination:** 1 x 1½ hr(s) paper(s) to be taken in Autumn.
Appendix VI:  FS3001 Academic Mentor’s Interim Report & Academic Mentor’s Note Book

School of Food & Nutritional Sciences & Associate
School of Food Business and Development.
(College of Science, Engineering and Food Science & College of Business and Law.)

Work Placement Programme 2011.

Academic Mentor’s Interim Report
(following visit to the student’s workplace or phone call to the student and Supervisor)

Name of Student: …………………… Course of Study: …………..

Company /Location: ……………………… Date of Visit: ………………..

Comments from Industry Mentor (Supervisor)  Signed……………… Date……………..

Comments from Student Signed……………………….. Date……………..

Log Book Examined and Signed  Yes ☐  No ☐

Comments / Recommendations from discussions with Industry Mentor and Student.
Include the prospects of a placement in 2012
Signed

Date

Academic Mentor
# Academic Mentor’s Note Book 2011

Student’s Name …………………….. Course: FS III, NS III, FB III or IDFP III. (Please circle as appropriate)

## CONTACTS RECORD

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## Placement Evaluation Form

(To be completed by the Academic Mentor)

Date of Visit ……………………………………………………………………………………………

Name of Company…………………………………………………………………………………………
Appendix V: The Showcase event in FS4002 (Team Product Development Project)
Appendix VI: Excerpt from External Examiner’s (Professor Peter Lillford) 2009/10 Report on the Food Science Programme at University College Cork.

In relation to modules (courses)

1. Did your review of the contents of modules indicate that they were both current and appropriate to the stage/year of programme at which they were delivered? Yes No

2. Were module objectives sufficiently well-defined and appropriate to the subject matter and to the stage/year of study? Yes No

3. Were you satisfied that the learning outcomes were aligned to the grading outcomes in the modules? Yes No

4. In your audit of the distribution of grades in modules did any give cause for concern? Yes No

5. Did failure rates in any modules give cause for concern? Yes No

6. Were you given the opportunity to audit a sample of graded assessments to confirm standards? Yes No

7. Did the existing assessments enable students to demonstrate achievement of the expected learning outcomes? Yes No

Comment: The taught modules are appropriate in content and level for each year. Grading is carefully carried out and all staff collaborate in developing an holistic view of students’ performance.

In relation to Programme:

1. Was the content appropriate to the level to the year of study? Yes No

2. Did you have adequate information to review assessment strategies within the programme? Yes No

3. Did you have adequate information to review assessment instruments (examination papers, continuous assessments, practicals, clinical assessments, etc.) within the programme? Yes No

4. Did you have any concerns about the overall grade distributions or failure rates within the programme? Yes No

5. Was the extent of the assessment requirements appropriate to the stage of the programme? Yes No

Comment: 2nd and 3rd Year - Continuous assessment and examination of taught courses is very good. As External examiner, I have been involved in both the setting of examination papers and their subsequent grading.

The 3rd year projects are to be commended. These allow either individual or team based activities. Whilst it is difficult to compare these directly, the contribution of individuals to team based projects is taken into account. The outcome of some of these are of an excellent standard, giving students a valuable training in working together and with students from Business Studies, whose background and interests are complementary.
In relation to Overall Quality:

1. Was the general quality of candidates’ work satisfactory? Yes ☒ No ☐
2. Were the standards achieved by the students consistent with those in your own university and/or in other universities in which you have acted as an Extern? Yes ☒ No ☐
3. Were you provided with adequate evidence that an appropriate review of the student achievement took place at School/School level? Yes ☒ No ☐
4. Were the distribution of final honours comparable with the distribution in other institutions? Yes ☒ No ☐
5. Were the procedures followed during the grading and examining process impartial and equitable? Yes ☒ No ☐
6. Was the administration of the assessment satisfactory? Yes ☒ No ☐
7. Did you have adequate time to carry out your examining duties? Yes ☒ No ☐

Comment: …by the time students reach their final assessment prior to graduation, the standards remain high. The distribution of grades for 3rd year students shows that less “good” grades will be awarded this year, but this relates to a poorer performance rather than elevation of marking standards. The course remains one of the highest quality when compared with others in the UK. The views of this year’s graduating class should be noted. All recognised the difficulty of the first 2 years, but recognise that staff was available for support and advice. The grading process is taken very seriously by all staff, and harmonisation has been improved over the 4 years of my External Examination.
Appendix VII: Example of University-level student questionnaire

**UNDERGRADUATE STUDENT QUESTIONNAIRE**

**BSc Food Science 1, 2, 3, 4 as applicable**

**TEACHING AND LEARNING**

**Course Provision**

<table>
<thead>
<tr>
<th></th>
<th>Not relevant</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
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</thead>
<tbody>
<tr>
<td>Presentation of material</td>
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<tr>
<td>Adequacy of notes</td>
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<tr>
<td>Accessibility of lecturers (by email or face to face)</td>
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<tr>
<td>Feedback on your performance</td>
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<tr>
<td>Overall quality of teaching</td>
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</tbody>
</table>

**Laboratory Provision (where applicable)**

<table>
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<tr>
<th></th>
<th>Not relevant</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
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<tbody>
<tr>
<td>Quality of laboratory handouts</td>
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<tr>
<td>Adequacy of supervision during laboratories</td>
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<tr>
<td>Feedback on your performance</td>
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<tr>
<td>Adequacy of laboratory facilities</td>
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**Project Work (where applicable)**

<table>
<thead>
<tr>
<th></th>
<th>Not relevant</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
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</thead>
<tbody>
<tr>
<td>Adequacy of supervision provided</td>
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<tr>
<td>Adequacy of Schoolal facilities and technical support during project work</td>
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<td>Feedback on your project performance</td>
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**OVERALL**

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<tr>
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<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
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<tbody>
<tr>
<td>Can you indicate your level of satisfaction with course</td>
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</table>
• If you have any suggestions for how any of the above might be improved please indicate them here. In particular the School is interested in knowing how you would suggest improving any area you have indicated as ‘Poor’ or ‘Fair’.

• Have you any suggestions for improvement of the overall lectures/tutorials/practicals you received? Please be specific and tell us which modules you are referring to.

• Have you any suggestions for improvement of the teaching in the course that you are studying? Please be specific and tell us which modules you are referring to.

• Have you any suggestions for improvement of the curriculum in the course you are studying?

• Have you any suggestions for improvement of the information given to you by the School and by the university which would, in your opinion, better enable you to plan your academic programme with some degree of certainty?

• Have you any suggestions on how the School can improve its methods of communication with you?

**Additional Comments**

There may be areas of activity that you feel are missing from the form or do not fit into any specific category but upon which you would like to comment. Please feel free to do so here.