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## Food Analysis Module Descriptor with SDGs Embedded

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## M1: Module Descriptor Template

Module Code	Pre-requisite Module codes	Co-Requisite Modules code(s)	ISCED Code	Subject Code	ECTS Credits	NFQ Level (CPD)#
TFBC3012					5	8
<b>Module Title</b>	Food Chemical Analysis					

This Header should be repeated on each page of the Module

**School Responsible:** Food Science and Environmental Health

### Module Overview:

The module aims to enable students to employ analytical techniques to food analysis to generate high quality analytical data.

This subject deals with principles of chemical analysis and the application of analytical methods to food, including the use of advanced instrumentation. An emphasis will be placed on extraction and analysis of nutraceutical components, including structure identification, and the role in circular bioeconomy. An emphasis will also be placed on the role of green chemistry in food analysis. Laboratory work involves the application of analytical methods to food, including the use of advanced instrumentation.

### Learning Outcomes (LO): (to be numbered)

For a 5ECTS module a range of 4-10 LOs is recommended

On Completion of this module, the learner will be able to

1	Describe the basic terminology of chemical analysis and explain the decision process for choice of methods, and use of validated methods.
2	Describe the principles of sampling
3	Explain the uses of traditional sample preparation techniques <u>as well as potential for greener solvents for extraction of bioactives.</u>
4	Describe aspects of laboratory Quality documentation for analytical methods
5	Describe applications of chemical techniques in food analysis, <u>and the role of green chemistry in analytical methods.</u>
6	Describe applications of instrumental techniques including rapid methods in food analysis
7	Discuss <u>global challenges food fraud</u> in the context of food chemistry and analysis: <u>food fraud and the impact of climate change on food chemical contaminants.</u>
8	Develop enhanced numeracy through in-class and in-practical calculations, including identification and reduction of variance.
9	Develop enhanced laboratory skills to perform high quality food analyses for a range of food constituents
10	Develop enhanced research and scientific writing skills to report on food analysis experiments

### Indicative Syllabus:

Indicative syllabus covered in the module and / or in its discrete elements

#### Describe the basic terminology of chemical analysis and explain the decision process for choice of methods, and use of validated methods.

Qualitative and quantitative methods. Wet and instrumental methods. Reasons for food analysis, and rational for choice of methods. Use of validated methods for high quality data.

#### Describe the principles of sampling

Explanation of sampling and sample plans. Obtaining and labelling a sample. Risks associated with sampling.

#### Explain the uses of traditional sample preparation techniques

Solvent extraction and role of greener solvents, precipitation, ashing, use of enzymes.

#### Describe aspects of laboratory Quality documentation for analytical methods

Steps and procedures involved in validation of analytical methods.

#### Describe applications of chemical techniques in food analysis

Principles of Green Chemistry. General principles for wet chemical analysis. A range of examples including acid/base chemistry, redox chemistry, salt analysis, protein analysis by Kjeldahl, fat characterisation and oxidation analysis.

#### Describe applications of instrumental techniques including rapid methods in food analysis

Spectroscopy applications – UV, AA, AE, fluorescence. IR, MS and NMR for structure identification for research.

Chromatographic applications –HPLC, GC

Rapid methods: Potentiometry, Hydrometry, Refractrometry, Freezing point analysis, Combined automated analysers.

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Global challenges in food chemistry and analysis, including food fraud and the impact of climate change. Discuss food fraud in the context of food chemistry and analysis  
 Case studies in food adulteration and fraud, including chemical food safety and methods for detection.  
Case study on impact of climate change on profile of food chemical contaminants: heavy metals, mycotoxins, methylmercury, microplastics.

### Develop enhanced laboratory skills to perform high quality food analyses for a range of food constituents

A range of experiments to develop good laboratory skills, numeracy, scientific reporting, and use of standard operating procedures. For example-  
 Chemical analysis by titration eg titratable acidity, peroxide value, Mohr method for chloride/salt (1 session)  
 Spectroscopic analysis by UV eg HMF in honey (1 session)  
 Extraction of bioactives from food waste by green solvent extraction (1 session)  
 Analysis of bioactives by antioxidant assays (1 session)  
 HPLC analysis of a food component (1 session)  
 Demonstration of NMR and workshop for structure identification by NMR, IR and MS (1 session)

### Develop enhanced research, numeracy and scientific writing skills to record and report on food analysis experiments

Maintaining a detailed laboratory notebook  
 Compiling a high standard scientific report based on a report template

### Learning and Teaching Methods:

Delivery by means of lectures with audiovisual aids, in-class activities, design thinking group workshops, computational problems and literature searches. The delivery will be a blend of face-to-face and online lectures and workshops, as well as onsite laboratory-based learning. The students will apply many of the principles and techniques in the Food Chemistry practical course.

Lectures 24 hours

Laboratory 18 hours (3 x 6 hours)

<b>Total Teaching Contact Hours</b>	42
<b>Total Self-Directed Learning Hours</b>	58

### Module Delivery Duration:

Normally over one semester

### Assessment

Assessment Type	Weighting (%)	LO Assessment (No.)
Written <u>assessment examination</u>	60	1-8
Laboratory report	10	8,10
Laboratory notebook	15	8,9,10
Laboratory exam	15	8,9

### Module Specific Assessment Arrangements (if applicable)

(a) Derogations from General Assessment Regulations	
(b) Module Assessment Thresholds	40% threshold for all components of assessments and 35% threshold for examination.  Laboratory practical exam: cannot be attempted if more than one of

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	<p>six lab sessions has been missed under normal circumstances. A repeat of the practical component is required in this case. This may be organised in the current academic session if possible, usually if a single practical session repeat is required. Otherwise the student must repeat the practical component of the module in the following academic session.</p>
(c) Special Repeat Assessment Arrangements	

### Essential Reading:

Analytical Chemistry for Technicians Kenkel, John Lewis Publishers, 2014, 4th edition.

Food analysis, edited by S. Suzanne Nielsen, New York ; Dordrecht : Springer, 2010, 4

### Supplemental Reading: (author, date, title, publisher)

Chemical analysis of food: techniques and applications, edited by Y. Pico., Oxford : Academic, 2012

Food The Chemistry of its Components, Coultate, T.P., The Royal Society of Chemistry, 2009, 5<sup>th</sup> Edition

Fennema's Food Chemistry, Srinivasan Damodaran (Editor), Kirk L. Parkin (Editor), Owen R. Fennema (Editor), CRC Press, 2017, 5<sup>th</sup> Edition

Food Chemistry, H.-D. Belitz (Author), Werner Grosch (Author), Peter Schieberle (Author), 4<sup>th</sup> Edition, 2009, Springer

[Climate change: Unpacking the burden on food safety \(fao.org\) \(http://www.fao.org/3/ca8185en/CA8185EN.pdf\)](http://www.fao.org/3/ca8185en/CA8185EN.pdf)

[Application of Deep Eutectic Solvents in Food Analysis: A Review, Molecules 2019, 24, 4594; doi:10.3390/molecules24244594](https://doi.org/10.3390/molecules24244594)

[Basics of Green Chemistry | Green Chemistry | US EPA https://www.epa.gov/greenchemistry/basics-green-chemistry\)](https://www.epa.gov/greenchemistry/basics-green-chemistry)

<b>Version No:</b>		<b>Amended By</b>	Julie Dunne
<b>Commencement Date</b>	Sept 2017	<b>Associated Programme Codes</b>	DT420

# Modules that are to be offered as Stand-Alone CPD Programmes must have an NFQ level assigned

\*Details of the assessment schedule should be contained in the student handbook for the programme stage.

**Date of Academic Council approval** .....