Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	**Food chemistry**
Course code	44705
Scientific sector	CHIM/10
Degree	Food Sciences for Innovation and Authenticity
Semester	II
Year	I
Academic year	2020/21
Credits	6
Modular	No

Total lecturing hours	36
Total lab hours	24
Attendance	Yes
Prerequisites	---
Course page	https://www.unibz.it/en/faculties/sciencetechnology/phd-in-food-engineering-and-biotechnology/phd-students-feb/person/34748-ksenia-morozova

Specific educational objectives	**Aims** The course discusses the basic principle of food chemistry. The chemistry of carbohydrates, lipids, proteins, and other constituents in fresh and processed foods are discussed and related to their effect on food quality. The course will offer also a deep understanding of the analytical techniques applied in analysis of foods. Students take an active role in learning course content (presented via Power Point presentations), which is available to class participants on the Food Chemistry web site, as well as laboratory activities. These include the chemical analysis of fruits, dairy and bakery products. **Educational objectives:** 1) the student is able to describe the main chemical properties of foods and ingredients and their functional role to the resulting food quality. 2) The student is able to describe the main analysis needed for quality control and how to report the results of the analysis.

Lecturer	Ksenia Morozova, NOI Tech Park, ksenia.morozova@unibz.it, +39 0471017211
Scientific sector of the lecturer	AGR/15
Teaching language	English

Office hours	32
Teaching assistant (if any)	Do be recruited
List of topics covered	**General food analysis** Expression of reagent concentrations. Measurement of pH, the use of mass balance, titration methods, refractometry, density and brix value. Buffer capacity and buffer preparation. Expression of the results. Repeatability and reproducibility. Trueness and recovery. Concentration calculation and preparation of standard solutions. Calibration curves, sensitivity, linearity and limit of detection. **Chemistry of fruits** Main compounds present in fruits: reducing sugars, antioxidants, vitamins. The role of pectin, pectin properties, formation of pectin gel. The role of water activity, pH and organic acids in fruits. Enzymatic and non-enzymatic browning reactions. Effect of thermal treatments on the chemical quality of processed fruits (fruit juices, canned fruits, jams, jellies and marmalades). Main chemical analysis for the quality control of fruit products. **Chemistry of milk and dairy products** Main compounds in milk and dairy products: lactose, proteins (casein and whey proteins), lipids. Concept of emulsion, foaming, creaming phenomena. Chemical reactions during dairy product preparation: yogurt gelation, cheese curd formation, ice-cream overrun. Cheese maturation and effect on flavor and taste. Methods for chemical analysis in the quality control of milk and dairy products. Methods for protein analysis (Kjeldahl, Dumas, spectrophotometric assays). **Chemistry of bakery products** Chemistry of cereals and flour. Main reactions in dough and bakery products: reducing group reactions. Starch and degraded starch properties. Gelation, gelatinization and retrogradation reactions. Gluten formation. Shortening in biscuits and pastry. Heat induced changes in bakery product quality. Maillard Reaction. Main chemical analysis in the quality control of bakery products. Methods for analysis of lipids. **Food oxidation** Oxidation reactions in food. Lipid oxidation. Radical chain reactions. Role and functions of antioxidants. Water soluble and lipid soluble antioxidants. Methods of analysis for antioxidant and radical scavenging activity. **Advanced analytical techniques for food analysis** UV-VIS spectroscopy. NIR and MIR spectroscopy. Basics of gas and liquid chromatography. Types of stationary phases. Column parameters: pore size, efficiency, number of theoretical plates, resolution. Introduction in mass

	spectrometry. Types of ionization techniques. Types of mass detectors. Interpretation of mass spectra.
Activity	Frontal lectures, exercises, labs, projects

Learning outcomes	The learning outcomes are: **Knowledge and understanding** Students are expected to understand and be able to control the major chemical and biochemical (enzymatic) reactions that influence food quality with emphasis on food analysis techniques. To understand how the properties of different food components and interactions among these components modulate the specific quality attributes of food systems, and to understand the principles that underlies the biochemical/enzymatic techniques used in food analysis. **Applying knowledge and understanding** The student will be able to apply the theoretical knowledge of on the chemical changes occurring to foods. Student will be able to apply the theoretical knowledge of analytical methods in practice during laboratory exercises. **Making judgements** The student will be able to analyze and compare the chemical properties of foods and their effect on its quality. **Communication skills** Communication skills will be evaluated in class through the discussion of case studies and in the lab through the evaluation of the laboratory activity. **Learning skills** The student will learn practical laboratory methods to analysis the chemical properties of foods.

Assessment	The assessment is based on a final written test.
Assessment language	English
Evaluation criteria and criteria for awarding marks	The evaluation consists of: • written test Criteria for the written test: • The test will be based on numerical questions. The students must answer correctly, taking in consideration the accuracy of the results and the estimated uncertainty, the figure of merits and unit of measurement.

	• The test will be based also on questions related to the food chemistry.

Required readings	Slide and spreadsheets discussed during the lecture.
Supplementary readings	H. D. Belitz, Foods chemistry, Springer, Doi: 10.1007/978-3-540-69934-7. Nielsen, S. Suzanne, ed. Food analysis. New York: Springer, 2010. Nollet, Leo ML, and Fidel Toldrá, eds. Food analysis by HPLC. CRC Press, 2012.