Syllabus

Course Description

Course Title	Information systems for the food and wine sector
Course Code	40413
Course Title Additional	
Scientific-Disciplinary Sector	IINF-01/A
Language	Italian
Degree Course	Bachelor in Enogastronomy in Mountain Areas
Other Degree Courses (Loaned)	
Lecturers	dr. Pietro Ibba, Pietro.Ibba@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/38503
Teaching Assistant	
Semester	First semester
Course Year/s	2nd
CP	6
Teaching Hours	36
Lab Hours	24
Individual Study Hours	90
Planned Office Hours	18
Contents Summary	1. Basics of chemistry and physics (electronics); 2. Basics of sensors and measurement techniques; 3. Overview and operational principles of chemical, optical, physical and biosensors; 4. Applications of sensor systems to food science and agriculture; 5. Sensor data analysis basics; 6. Outlook in future sensor technologies.
Course Topics	1. Basic concepts of chemistry and physics (electronics) Review of general chemistry: atoms, molecules, chemical bonds, reactions, and solutions.

	Principles of physics applied to sensors: electricity, magnetism, conduction, semiconductors. Fundamentals of electronics: resistance, capacitance, inductance, basic circuits, and electrical signals. 2. Fundamentals of sensors and measurement techniques Definition of sensors and actuators, characteristic parameters (sensitivity, selectivity, dynamic range, response time). Classification of sensors based on their operating principle. Measurement techniques: signal acquisition, conditioning, and transmission. Concepts of calibration, accuracy, precision, and measurement uncertainty. 3. Overview and operating principles of chemical, optical, physical, and biosensors Chemical sensors: electrochemical, gas, ion, spectroscopic. Optical sensors: absorption, fluorescence, NIR and Raman spectroscopy, optical fibers. Physical sensors: temperature, pressure, humidity, motion, images (vision systems). Biosensors: biological components (enzymes, antibodies, DNA), transducers, and biomedical and agri-food applications. 4. Applications of sensor systems in food science and agriculture Monitoring food quality and safety (freshness, contaminants, shelf life). Sensors for controlling processing and preservation processes. Integration with IoT systems and sensor networks for real-time monitoring. 5. Basics of sensor data analysis Introduction to data acquisition and pre-processing. Basic concepts of multivariate analysis (PCA, regression) and machine learning for sensor data. Data visualization and interpretation for decision support. 6. Perspectives on innovative technologies Emerging developments in materials and nanotechnologies for sensors.

	Edible electronics
Keywords	Sensors & Transducers; Measurement Techniques; Data Analysis; Food Quality & Safety; Innovation & Sustainability; Biosensors
Recommended Prerequisites	
Propaedeutic Courses	None
Teaching Format	Class hours are divided into: - Presentations and theoretical lessons in the classroom, - Exercises and laboratory sessions. The material (notes, presentations, videos, reading and learning material, etc.) for lessons, exercises, and laboratories will be provided by the instructor and will be available before the lesson.
Mandatory Attendance	No
Specific Educational Objectives and Learning Outcomes	Knowledge and understanding of how sensors work, of the advantages/disadvantage of competing technologies and of the potential application fields. Applying knowledge and understanding in scientific and professional environments. Making judgments when assessing different solutions for a given scientific or technical problem on the basis of performance and on the trade-off with cost. Communication skills in presenting scientific results in written and oral form, in particular using an appropriate English language. Learning skills concerning the ability to find information on the web and assess their validity, to use and transmit the technical knowledge acquired in the course.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	Assessment takes place in two stages: an intermediate multiple-choice exam on the first theoretical part of the course and a final oral exam aimed at testing theoretical knowledge, presentation skills, and practical knowledge acquired during the course. The oral part consists of a scientific presentation (with the aid of PowerPoint) on a specific topic to be prepared individually at home, followed by specific questions on the course and laboratory topics.
Evaluation Criteria	The assessment criteria are accuracy and clarity of answers,

	mastery of oral presentations (including the language of instruction), depth of knowledge acquired, and critical thinking skills. In addition, the ability to establish relationships between different topics will be assessed.
Required Readings	The material (notes, presentations, videos, reading and learning material, etc.) for lessons, exercises, and laboratories will be provided by the instructor and will be available before the lesson.
Supplementary Readings	
Further Information	
Sustainable Development Goals (SDGs)	Zero hunger, Responsible consumption and production, Industry, innovation and infrastructure