# Innovation in Agri-Food Systems and Technology

Prof. Tommaso Frioni; Prof. Gianluca Giuberti; Prof. Lorenzo Stagnati

# *Principles of Agri-food Systems - UNIT I*

## *Prof. Tommaso Frioni*

***COURSE OBJECTIVES AND EXPECTED LEARNING OUTCOMES***

The course aims to provide students with an insight into the main aspects related to agricultural processes and an understanding of the most relevant technical aspects in relation to the sustainability of production and to the innovation in agriculture, in order to build up a language and competence that will enable them to bridge the needs of experts and the demands of the citizen-consumer. Knowledge of these protocols will be fundamental in a perspective of exchange between experts and citizen-consumers as it will facilitate dialogue between the parties and promote the transparency of the evaluation system.

The students will be able to determine the effects of different production models (e.g.: organic vs. integrated production), in relation to the objectives and purposes of agri-food products and their destination.

The students will be able to know the main elements that contribute to the quality of agri-food products and the techniques available to regulate their main attributes, with specific case studies related to tree crops.

The student will be able to: i. Promote active exchange between lay citizen, sector experts and research ii. Judge the predisposition of the main agricultural systems to technological innovation, precision techniques and automation, in relation to the specific needs of the industry and the perception of those involved in agricultural production, and not; iii. Judge the impact of the main management techniques on the qualitative aspects of production and their sustainability.

***COURSE CONTENT***

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|  | **CFU** |
| **General Part** |  |
| Introduction to agricultural production and its quality | 0.5 |
| Agronomic techniques in the main cropping systems | 0.5 |
| Farming models and sustainability of agricultural production | 0.5 |
| **Applied Part: Evaluation of two specific supply chains** |  |
| Olive orchards: Productive models, most common cultivars and main quality parameters | 0.75 |
| Viticulture: Cultivars and quality, main cultural techniques, climate change adaptation strategies | 0.75 |

***READING LIST***

KUMAR, S., MEENA, R. S., & JHARIYA, M. K. (Eds.). (2020). *Resources use efficiency in agriculture* (p. 760). Singapore: Springer.

JACKSOON D, LOONEY N, MORLEY-BUNKER M, THIELE G.(EDS.) 2011. Temperate and subtropical fruit production. Cabi pp.327.

TROMP, J., A.D. WEBSTER & S.J. WERTHEIM (EDS) 2005. Fundamentals of Temperate Zone Tree Fruit Production, 400 pp

***TEACHING METHOD***

Classroom lectures with the support of ppt/pdf video projection. Teaching materials used during the lectures will be provided.

***ASSESSMENT METHOD AND CRITERIA***

Method of assessing learning outcomes by means of a final written examination. Students will be given 45 min. to answer closed theoretical questions on the topics of the syllabus. There will be 15 closed questions of equal weight (2 marks each). In the event of a no answer or wrong answer, no points will be awarded.

***NOTES AND PREREQUISITES****\*

In the event that the health situation relating to the Covid-19 pandemic does not allow for face-to-face teaching, distance teaching will be guaranteed in a synchronous or asynchronous manner, which will be communicated to students in good time.

*Time and place of student reception*

Prof. Tommaso Frioni receives students at the end of lectures and by appointment in Piacenza (DIPROVES – Viticulture Area).

# *Principles of Innovative Biotechnologies UNIT - II*

## *Prof. Lorenzo Stagnati*

***UNIT AIM AND INTENDED LEARNING OUTCOMES***

The module provides an overview of the impact and perspective of biotechnologies to increase food supply and safety. The students will have the knowledge to develop citizen science approaches to improve the dialogue between scientific research and society and address the emerging challenges of modern agronomy and genomics. The students are introduced to the main classical breeding and new biotechnology techniques targeting quantitative and qualitative traits as well as resilience to climate changes of the agricultural productions that benefit farmers, industries and consumers. The students learn the importance of genetic variations available for breeders and the key tools to create genetically engineered and genome edited crops.

Case studies of both herbaceous and tree species will be presented and addressed according to the relevance of the different content of the course

The module is carried out in the 1st term and consists of 3.0 CFU (21 hours) of lectures.

The module aims to:

1) illustrate the most basics knowledge on genetics and biotechnology;

2) introduce the students to the domestication of food crops, the presence and relevance of agricultural biodiversity;

3) outline the main aspects of breeding, the identification of different needs and the strategies to develop new crop varieties;

4) introduce basic concepts of Genetically Modiefied Organisms and Genome Editing with particular attention to their potential to meet agricultural sustainability, crop adaptation to climate change and diseases in order to guarantee food safety and security.

Learning outcomes:

After successful completion of the module, students are expected to be able:

- to have the most important basic knowledge concerning DNA and biological processes involving DNA;

- to explain the process of breeding, why breeding is necessary and to identify the objective of different breeding plans;

- to explain what are genetic variation and biodiversity and the importance of genetic variation in breeding processes;

- to understand and to explain biotechnological application and relevance in present day agriculture;

- to understand what Genetically Modified Organisms and Genome Edited crops are, how they can be produced and their importance for modern agriculture sustainability.

***COURSE CONTENT***

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| --- | --- |
|  | CFU |
| DNA, genes and the genome – composition, structure, organisation in chromosomes (nuclear and organellar chromosomes), DNA replication, transcription and translation | 0.45 |
| Basic concept of Mendelian genetics | 0.28 |
| Mutations as source of new informations  | 0.14 |
| Domestication of food crops | 0.28 |
| Agricultural biodiversity: how to protect and use genetic resources | 0.28 |
| Introduction to breeding | 0.45 |
| Breeding for yield and the “Green revolution” | 0.28 |
| Genetically Modified Organisms and Genome Editing | 0.28 |
| Breeding with GMO: examples of introduced traits | 0.28 |
| The potential of New Breeding Techniques | 0.28 |

***READING LIST***

CHRISPEELS M.J., GEPTS P. Plants, Genes & Agriculture. Sustainability through Biotechnology. SINAUER Associates. New York: Oxford University Press, 2017.

Papers from the scientific literature that will be provided by the teacher.

Power point presentations will be made available during the course before the beginning of each new topic/class.

***TEACHING METHOD***

Indoor classes where the main course topics will be covered along with several applied examples taken from textbook or scientific literature. Questions will be posed to stimulate discussion.

***ASSESSMENT METHOD AND CRITERIA***

The assessment will take the form one written tests consisting of 32 questions each one regarding the main arguments of the course, lasting 90 minutes. They will consist of multiple-choice questions (1 point for each correct answer, 0 point for each wrong answer) with students choosing from four possible answers. Pass mark is 18/30 out of 30/30. A bonus mark (lode) will be awarded to those students who will correctly answer to more than 30 questions.

***NOTES AND PREREQUISITES****\*

The course does not need particular prerequisites.

*Time and place of student reception*

Prof. Lorenzo Stagnati is available to meet with students at the end of classes or at the DIPROVES (Agronomy and Biotechnology area).

# *Principles of Food Processing- Unit III*

## *Prof. Gianluca Giuberti*

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The course aims to provide students with a general understanding of the main processes of food technology, with applicable references to innovative technologies. Through the knowledge of the main process phases and inherent parameters, the student will acquire the essential tools to understand the agri-food chain to communicate information to specialists and non-specialists. At the end of the course, the student will be able to: 1) autonomously operate and demonstrate applicative knowledge of the main technological processes involved in the transformation and production of food; 2) acquire an integrated interpretative scheme for studying consumer behaviour.

In addition, the student will be able to: 1) identify the technological conditions to guarantee the nutritional and/or technological quality and minimize negative processing; 2) identify the relationship between qualitative characteristics and the technological conditions adopted; 3) acquire an adequate technical language.

***COURSE CONTENT***

|  |  |
| --- | --- |
|  | **ECTS** |
| **General section** |  |
| Introduction to food technologies and food technology processes.  | 1.0 |
| Food heat treatments: principles and main systems. | 0.5 |
| **Applied section: examination of a few supply chains**  |  |
| Oil industry: unit operations, extraction systems, and the main by-products of the supply chain. | 0.75 |
| Pasta production: main technological processes with particular attention to the definition of the characteristics that illustrate compositional, structural, and nutritional quality in the wheat-based sector. | 0.75 |

***READING LIST***

H. Ramaswamy-M. Marcotte, *Food Processing. Principles and Applications,* Taylor& Francis Group, New York, 2006.

D.R. Heldman-R.W. Hartel, *Principles of food processing,* Chapman&Hall, New York, copyr. 1997.

Maningat, C.C., Seib, P.A., Bassi, S.D., Woo, K.S., Lasater, G.D., 2009. Wheat starch: production, properties, modiﬁcation and uses. In: Bemiller, J.N., Whistler, R.L. (Eds.), Starch: Chemistry and Technology. Academic Press, New York, USA

***TEACHING METHOD***

Lectures in the classroom using video projection support. The teaching materials used during lectures will be provided.

***ASSESSMENT METHOD AND CRITERIA***

A final written exam. Students will be given 60 minutes to answer closed theoretical questions on the course topics covered. On average 30 closed questions of equal weight (1 mark each). In case of no answer, no marks will be awarded. Suppose group work is carried out during the scheduled hours. In that case, students will be assessed on their final PowerPoint presentation of this work (from 0 to 2 marks, depending on the completeness and clarity of the presentation). The final mark will consider both the written exam and the group work assessment.

NOTES AND PREREQUISITES

The course requires a knowledge of mathematics, food chemistry and microbiology.

Information on office hours available on the teacher's personal page at http://docenti.unicatt.it/.