# .- Food Technology and Plants

## Prof. Giorgia Spigno

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

The overall aim of this course is to provide students with knowledge in the technological area, in particular in relation to the use of application tools and analysis methods in food industry processes, so as to optimise production cycles from a global quality point of view.

At the end of the course, students will know: the method for calculating the lethality of a heat treatment as an application tool for controlling, predicting and optimising processes; the problems regarding the sizing of heat exchangers in the design phase and their management within transformation processes; the process and product parameters that can be optimised in non-stationary heat treatments; the principles underlying the development and industrial implementation of unconventional and innovative technologies; and the key elements of an industrial approach to sustainable development and the development of new products or new production lines.

Based on the knowledge acquired, students will be able to identify the key parameters for controlling and optimising heat processes, including through the choice of non-conventional technologies. Students will be able to formulate product and process development hypotheses and scenarios from a technical, economic, environmental and social point of view.

***COURSE CONTENT***

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|  | ECTS |
| **Optimisation of conventional heat treatments** |  |
| Calculation of treatment times and lethality for continuous and discontinuous processes | 1.5 |
| Estimation and calculation of heat transfer coefficients, and design optimisation of the main heat exchangers | 1.5 |
| Unsteady-state heat transfer | 1.0 |
| **Unconventional treatments** |  |
| Overview of thermal technologies (ohmic, microwave, radiofrequency, infrared heating) and non-thermal technologies (high pressure treatments, irradiation, ultrasound, pulsed electric fields, plasma) | 2.0 |
| **Technical-economic elements for plant and process development** |  |
| Technical-economic elements for the design of new production lines, new production facilities and new products. | 1.00 |
| **Sustainability of Food Processes** |  |
| Overview of the concepts and problems underlying sustainability in the food sector, so as to understand it and imagine solutions for increasing it. | 1.00 |
| **Tutorials** | 2.0 |
| The solving of problems related to the calculation and optimisation of conventional heat treatments. Seminars with company testimonials. Possible group work on process development and sustainability. |  |

***READING LIST***

D.R. Heldman-R.W. Hartel, *Principles of Food Processing,* Int. Thomson Publishing, New York, 1997.

M. Karel-D.B. Lund, *Physical Principles of Food Preservation,* Marcel Dekker, Inc, New York, 2003.

F.A.R. Oliveira-J.C. Oliveira, *Processing Foods. Quality Optimisation and Process Assessment,* CRC Press, New York, 1999.

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

R.P. Singh-D.R. Heldman, *Introduction to Food Engineering. Fifth edition*. Academic Press, Burlington USA, 2014.

K.J. Valentas-E. Rotstein-R.P. Singh, *Handbook of Food Engineering Practice,* CRC Press, New York, 1997.

Lecturer's notes.

Aids related to specific topics will be provided during the course.

***TEACHING METHOD***

1. Theoretical frontal and dialogue-based lectures aimed at presenting the key concepts of the subject.

2. Frontal tutorials involving the assisted solving of numerical problems related to conventional heat treatments and technical-economic aspects of new product and process development.

3. Assignment of working groups for the resolution of specific case-studies related to the course topics.

4. Classroom seminars with company testimonials.

5. A possible educational visit to a food company.

***ASSESSMENT METHOD AND CRITERIA***

There will be a final written exam followed by possible oral discussion. Students will be given 2 hours to solve numerical exercises and answer open-ended theoretical questions. On average, 2-3 exercises will be given and 2 questions. In case of no answer or resolution, no marks will be awarded, while incorrect answers and errors in carrying out the exercises may result in penalties. The open-ended questions will also assess the student's appropriate use of the specific technical terminology used during the course. At the beginning of the course it will be indicated if group work will be carried out during the year, with an illustration of the topics and aims of the work, and the requirements of the final report. In this case, the final mark will consider both the written exam and the group work assessment.

***NOTES AND PREREQUISITES***

The course requires a knowledge of unit operations in the food industry.

In case the current Covid-19 health emergency does not allow frontal teaching, remote teaching will be carried out through synchronous or asynchronous procedures that will be promptly notified to students.

***OFFICE HOURS FOR STUDENTS***

Prof. Giorgia Spigno is available for the students after the lectures held in Cremona In addition she is available to receive students following specific appointment or through remote meetings. In any case, it is suggested to write an e-mail ([giorgia.spigno@unicatt.it](mailto:giorgia.spigno@unicatt.it)) in order to agree on the day and time of reception