

General information	
Academic subject	<b>Storage systems (I.C. Agro-food processing plant)</b>
Degree course	<i>Food Science and Technology (L26)</i>
Academic Year	<i>Second</i>
European Credit Transfer and Accumulation System (ECTS)	3 ECTS
Language	<i>Italian</i>
Academic calendar (starting and ending date)	<i>September 26<sup>th</sup>, 2022 – January 20<sup>th</sup>, 2023</i>
Attendance	<i>No Compulsory</i>

Professor/ Lecturer	
Name and Surname	Antonia Tamborrino
E-mail	antonia.tamborrino@uniba.it
Telephone	0805443122
Department and address	<i>Disaat</i>
Virtual headquarters	<i>Microsoft Teams</i>
Tutoring (time and day)	Monday-Friday 9.00-16.00

Syllabus	
<b>Learning Objectives</b>	<i>The student will acquire knowledge and skills on the design and specifications of the machines and plant used in the storage equipment.</i>
<b>Course prerequisites</b>	<i>Prerequisites: mathematics and physics</i>
<b>Contents</b>	<ul style="list-style-type: none"> <li>- <i>Applications of thermodynamics principles to the agro-food storage processing.</i></li> <li>- <i>Harvest and postharvest machine (Field packing; Harvesting for packing in a packinghouse; Postharvest handling systems; Initial cooling and storage systems; Bin dumping machines; Presiding machines; Cleaning and washing machines; Special operations machines; Sorting line; Packing machines; Cooling horticultural commodities;)</i></li> <li>- <i>Storage systems for agro-food products:</i> <ol style="list-style-type: none"> <li>1. <i>Descriptive and critical analysis of drying plant (Drying plant, concentration plant, evaporation and membrane concentrators, crio-concentration);</i></li> <li>2. <i>Descriptive analysis and critical of machines that use the heat as principle of conservation (pasteurization and sterilization plant);</i></li> <li>3. <i>Descriptive and critical analysis of cold storage machines and systems (freezing plant).</i></li> </ol> </li> <li>- <i>Plant projecting (machinery and equipment).</i></li> <li>- <i>Refrigerator system; Vapor recompression refrigeration system (expansions valves; evaporators; compressors; condenser; circuits and refrigerants).</i></li> <li>- <i>The storage building (Refrigerating room, thermal load and design).</i></li> </ul>
<b>Books and bibliography</b>	<p><i>CIGR – The International Commission of Agricultural Engineering “HANDBOOK OF AGRICULTURAL ENGINEERING” Agro Processing Engineering, Published by: ASAE;</i></p> <p><i>Armando Monte “Elementi di Impianti Industriali” Volume II, Edizioni Libreria Cortina Torino;</i></p> <p><i>Toledo R.T., “Fundamentals of Food Process Engineering”, Van Nostrand Reinhold, New York (USA), 1991.</i></p> <p><i>Rapin P.J. “Impianti Frigoriferi”. Edizione Tecniche nuove.</i></p> <p><i>Ingegneria dell'industria alimentare. Operazioni unitarie del food engineering. Macchine e impianti. D. Friso; CLEUP, 2013.</i></p>

	<i>Colelli G., and Inglese P. "Gestione della qualità e conservazione dei prodotti ortofrutticoli" Edagricole Università e Formazione. 2020.</i>
<b>Additional materials</b>	<i>Notes, slides and other bibliographic materials will be furnished during the course</i>

<b>Work schedule</b>			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/Self-study hours
<b>Hours</b>			
30	14	16	48
<b>ECTS</b>			
3	2	1	
<b>Teaching strategy</b>	<p><i>Lectures will be presented through PC assisted tools (PowerPoint, video). Field and laboratory classes, reading of regulations will be experienced.</i></p> <p><i>Lecture notes and educational supplies will be provided by means of online platforms</i></p>		
<b>Expected learning outcomes</b>	<p>The expected learning outcomes, in terms of both knowledge and skills, are provided in Annex A of the Academic Regulations of the Degree in Food Science and Technology (expressed through the European Descriptors of the qualification)</p>		
<b>Knowledge and understanding on:</b>	<ul style="list-style-type: none"> <li>- <i>Knowledge of the principles and laws of thermodynamics;</i></li> <li>- <i>Knowledge of the principles of the refrigeration cycle and knowledge of the individual components of a refrigerating machine;</i></li> <li>- <i>Knowledge of thermal loads related to a refrigerating warehouse;</i></li> <li>- <i>Knowledge of the various types of agro-food storage systems;</i></li> <li>- <i>Knowledge of machinery and plant solutions adopted for agri-food storage plant.</i></li> <li>- <i>Knowledge about the layout of the food-processing industry.</i></li> </ul>		
<b>Applying knowledge and understanding on:</b>	<ul style="list-style-type: none"> <li>- <i>Ability to apply the laws of thermodynamics to the conservation of agri-food products;</i></li> <li>- <i>Ability to make the specification of a refrigerating machine;</i></li> <li>- <i>Capacity to calculate thermal loads for a refrigeration warehouse.</i></li> <li>- <i>Capacity to describe the operation and dimensioning of machines and plant for the preservation of agri-food products;</i></li> <li>- <i>Ability to apply the main typologies of machines commonly used in the agri-food industry, considering both the operating principle and the criteria guiding the choice.</i></li> </ul>		
<b>Soft skills</b>	<p><i>Making informed judgments and choices</i></p> <ul style="list-style-type: none"> <li>- <i>Ability to assess the main design aspects of machines and plant for the storage equipment of agri-food products.</i></li> <li>- <i>Ability to correctly and critically evaluate plant and machine specifications that can be used depending on the type of product to be stored, the needs and the structure of the company.</i></li> </ul> <p><i>Communicating knowledge and understanding</i></p> <ul style="list-style-type: none"> <li>- <i>Ability to describe the design aspects of machines and plant for the storage equipment of agri-food products.</i></li> <li>- <i>Ability to interact with the various actors involved in a food industry with a technical language.</i></li> </ul> <p><i>Capacities to continue learning</i></p> <ul style="list-style-type: none"> <li>- <i>Ability to deepen and update the knowledge about machines and plant for the storage system of agro-food products.</i></li> </ul>		

The expected learning outcomes, in terms of both knowledge and skills, are provided in Annex A of the Academic Regulations of the Degree in Food Science and Technology (expressed through the European Descriptors of the qualification).

<b>Assessment and feedback</b>	
Methods of assessment	<p>The exam consists of an oral dissertation on the topics developed during the theoretical and theoretical-practical lectures in the classroom and in the laboratory production plants, as reported in the Academic Regulations for the Bachelor Degree in Food Science and Technology (article 9) and in the study plan (Annex A).</p> <p>Students attending at the lectures may have a middle-term preliminary exam, consisting of a written test, relative to the first part of the program, which will concur to the final evaluation and will be considered valid for a year.</p> <p>The evaluation of the preparation of the student occurs on the basis of established criteria, as detailed in Annex B of the Academic Regulations for the Bachelor's degree in food science and Technology.</p> <p>The foreign student's profit test can be done in English in the way described above.</p>
Evaluation criteria	<ul style="list-style-type: none"> <li>• <i>Knowledge and understanding</i> <ul style="list-style-type: none"> <li>○ Basic knowledge of the main aspects for the design of storage equipment and plant.</li> </ul> </li> <li>• <i>Applying knowledge and understanding</i> <ul style="list-style-type: none"> <li>○ Exercise and case studies on machines and plant with references to different type of companies and industries</li> </ul> </li> <li>• <i>Autonomy of judgment</i> <ul style="list-style-type: none"> <li>○ Properly and critically express plant and machine specifications that can be used depending on the type of product to be retained, the needs and the structure of the company. Express opinion adequately on the operations and machines and plant.</li> </ul> </li> <li>• <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> <li>○ Describe the main typologies of machines commonly used in the agro-food industry, considering both the operating principle and the criteria guiding the choice using appropriate vocabulary</li> </ul> </li> <li>• <i>Communication skills</i> <ul style="list-style-type: none"> <li>○ The student will be evaluated considering the use of appropriate technical language.</li> </ul> </li> <li>• <i>Capacities to continue learning</i> <ul style="list-style-type: none"> <li>○ Analyzing in a critical way concrete situations and case studies, working in team and managing strict deadline.</li> </ul> </li> </ul>
Criteria for assessment and attribution of the final mark	<p>The evaluation criteria that contribute to the attribution of the final mark will be: knowledge and understanding, the ability to apply knowledge, autonomy of judgment, i.e. the ability to criticize and formulate judgments, communication skills</p>
<b>Additional information</b>	