General Information	
Academic subject	Machines and plants for food processing
Degree course	Master Programme: Food science and technology
ECTS credits	6 ECTS
Compulsory attendance	No
Teaching language	Italian

Subject teacher	Name Surname	Mail address	SSD
	Biagio Bianchi	biagio.bianchi@uniba.it	AGR/09

ECTS credits details		
Basic teaching activities	5 ECTS Lectures	1 ECTS Laboratory or field classes

Class schedule	
Period	I semester
Course year	First
Type of class	Lecture- workshops

Time management	
Hours	150
In-class study hours	54
Out-of-class study hours	96

Academic calendar	
Class begins	September 28^{h}, 2020
Class ends	January 22th, 2021

Syllabus	
Prerequisites/requirements	Knowledge of: Physics, Calculus and Unit Operations.
Expected learning outcomes	*Knowledge and understanding* ○ Mastery in the design, management and logistics of mass and energy exchanges in the food industry ○ Knowledge of the issues related to the environmental impact of mass and energy exchanges *Applying knowledge and understanding* ○ Ability to carry out basic design and application of the design solutions ○ Ability in defining layouts for mass and energy exchange in food processes, also based on the possibilities of energy recovery and the need to minimize the environmental impact *Making informed judgements and choices* ○ Ability to correctly carry out the research for mechanical and plant solutions that are correct to change the characteristics and quality of foodstuffs ○ Ability to correctly guide the choice of suitable technical solutions to monitor mass and energy exchanges in food processes ○ Ability to evaluate technical and plant choices related to the environmental sustainability of primary productions *Communicating knowledge and understanding* ○ Ability to establish a professional dialogue with other professionals and operators in the industry, concerning to the definition of mass and energy flows, the layouts definition, and the testing of the studied plants *Capacities to continue learning*

	○ Ability to develop and update knowledge of mass and energy exchanges in food processes 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)
Contents	Heat exchanges in the food industry, deepening radiation transmission. Open thermodynamic systems. Indications of fuels, notes on thermal and steam generators. Rankine Cycle, absorption refrigerator loop, alternative cooling fluid, heat pump. Empty systems. Mass and energy exchanges in concentration processes: - Thermodynamics of discontinuous, continuous thermal film concentrators, with falling film and forced circulation; - Fluidodynamics of the membrane concentration. Mass and energy exchanges in drying food: - Hygrometry; - Thermohygrometric applications on sausage and cheese factory; - Balance of matter and energy in drying plants.
Course program	
Reference books	*Support materials* ▪ Yunus A., Çengel "Termodinamica e trasmissione del calore" Mc Graw-Hill; ▪ Friso D., "INGEGNERIA DELL'INDUSTRIA AGROALIMENTARE", Volume I – Teoria, applicazioni e dimensionamento delle macchine e impianti per le operazioni unitarie, CLEUP sc, Padova, 2017 (www.cleup.it); ▪ Peri C. "La Filtrazione nell'Industria Alimentare", Parte. 1, 2 e 3, CUSL, Milano, 1994; ▪ Autori vari "Lo scambio termico nell'industria alimentare" Chirotti Editore; ▪ P.J. Fellows, Food processing technology, principles and practice, CRC Press, Boca Raton Boston New York Washinton, DC, 2000; ▪ Giovanni Quaglia, Scienza e Tecnologia degli Alimenti, Chiriotti Editori, Pinerolo, 1992. ▪ Lecture notes *Additional readings* • ASHRAE (2005), *Fundamentals 2005 Ashrae Handbook*, Amer Society of Heating.
Notes	Supplementary Supplements (periodically updated) are enclosed with a bibliography in which specific publications and other texts are recalled to deepen each topic.
Teaching methods	Lectures will be presented through PC assisted tools (Powerpoint). Lecture notes and educational supplies will be provided by means of email or online platforms (i.e.: Edmodo)
Evaluation methods	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 Master Degree in Food Science and Technology (article 9) and in the study plan (Annex A). Students attending at the lectures may have a middle-term preliminary exam, consisting of an 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. 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 Master Degree in Food Science and Technology. Non-Italian students may be examined in English language, according to the aforesaid procedures.
Evaluation criteria	*Knowledge and understanding* ○ Description of mass and energy exchanges in plants studied during the course; ○ Determination of operation, components, and working of the energy processes studied during the course; ○ Description of operation of thermodynamic systems studied during the course; ○ Description of layouts studied during the course. *Applying knowledge and understanding* ○ Making of mass and energy balances using the methods used in theoretical-practical lessons and exercises. ○ Definition of criteria for choice of thermodynamic systems and layouts according to examples presented as case studies. *Making informed judgements and choices* ○ Proposals of changes in the thermodynamic systems based on the quantitative, qualitative and ecological requirements of the processes studied. *Communicating knowledge and understanding* ○ Ability to develop relationships and professional collaborations. *Capacities to continue learning* ○ Ability to extend the acquired knowledge to untreated mass and heat exchanges food processes.
Receiving times	From Monday to Friday by appointment only