

COURSE: Food Engineering –Module: machines and plants for the agro-food industry

ACADEMIC YEAR: 2018/2019

TYPE OF EDUCATIONAL ACTIVITY: Basic

TEACHER: Prof. Giovanni Carlo Di Renzo and dott. Francesco Genovese

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Language: Italian

ECTS: 6 (5+1)	n. of hours: 56 (40+16)	Campus: Potenza/Matera Dept./School: School of agriculture, forestry, food and environmental sciences Program:	Semester: II
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EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course of Food Engineering – Module. Machinery and Equipment for Agro Food Industry aims to deepen the technical aspects related to Food Engineering and processing operations, with particular reference to local food production (Olive oil extraction, dairy processing, Wine production, Fruits and vegetables postharvest). Therefore, as part of the course will cover topics related to the design, construction and operation of all machinery and plants present in the modern food industry, with reference both to small and medium-large size companies. The lectures, supplemented with seminars by industry experts, are accompanied by practical exercises held in the laboratory of pilot plants, where experimental tests on all the prototypes used for laboratory purposes will be carried out, with active participation of students. The goal is to provide students with the knowledge of the basic elements for the selection and sizing of the machines and equipment used for the execution of unit operations performed during food processing, and knowledge about the start and the use of machines.

- **knowledge and understanding:** Students acquire Knowledge and understanding of the relation between the machine/plant mode of operation and the final quality of food, the energy and water requirement, the waste production; identify sources of raw material; explain the variability and the impact on food processing plant and equipment.
- **applying knowledge and understanding:** to apply the fundamental concepts of mass, heat, and momentum transfer required in relation with the equipment/plant used for agro food processing and the quality of the final product; apply the knowledge of the major components of a processing line for high quality products; knowledge of the plant layout for the major Italian food: olive oil, wine, mozzarella cheese and fresh and ready-to-eat fruits and vegetables, pasta;
- **making judgements:** Students develop ability to identify the most effective design, technical solution, construction material, control system for food quality assurance in the development of new products and processes and in the improvement of existing ones; capacity to evaluate the design and layout criteria of production plant for food and agricultural foodstuff; to evaluate and choose the optimal processing parameters of the plant in order to control and increase the quality.
- **communication skills:** Ability to communicate the effects of the impact of effective design, technical solution, construction material, control system on food quality assurance to both non-technical and technical audiences. Risk communication skills. Ability to interact and communicate with food business operators and representative of companies involved in the development and implementation of machine and plant for the food industry. Ability to communicate with representative of food safety agencies, official control agencies and quality certification agencies in all the steps needed for the registration and approval of a food production/distribution plant and during quality and safety audits.

learning skill: Ability to access sources of data, documentation and information sources on food engineering and machine and plant for dairy processing using technical and scientific literature.

PRE-REQUIREMENTS

A good knowledge of Physics and Engineering Thermodynamics

SYLLABUS



Introduction on machines, electric engine, power transmission (4h)

Introduction on production and productivity of agro-industrial plants.

General equation of machines. Efficiency of a machine. Passive resistance. Electric engine and power transmission.

Machines for food liquids (6h + 4h laboratory)

Pumps. Characteristic curves types: volumetric and continuous flow.

Pumps used in the food industry: pistons, lobe, peristaltic, membrane, mono, deformable impeller, centrifugal.

Machines for gaseous fluids (4h + 2h Lab)

Fans. Classification of fans used in the food industry: axial and centrifugal; selection criteria.

Machines for gaseous: compressors. Characteristic curves and methods of use.

The heat exchangers (4h + 2h laboratory)

Heat exchangers. The laws of heat exchange.

Heat exchangers in the food industry for the liquid / liquid treatment: direct injection; cavity, serpentine, tube in tube, tube bundle and plate and scraped surface.

Refrigeration systems (6h + 4h Lab)

Refrigeration cycle in relation to refrigeration equipment for the food industry.

Fluids in the refrigeration of food.

Systems for direct cooling.

The use of intermediate fluids for indirect refrigeration.

Selection criteria. Refrigeration systems and freezing of food products.

Machines for centrifugal separation (4h)

Machines for liquid / liquid or solid / liquid: clarifiers and centrifuges.

The application of Stokes law to sedimentation and centrifugation.

Disks centrifuge.

Decanter. The two-phase decanter and the three-phase decanter.

The influence of the speed control, the torque control and the geometrical characteristics.

Machines for liquid filtration (4h + 2h Lab)

Filters and selection criteria in relation to the quality of the finished product.

Laws governing the filtration for liquid product.

Filtration adjuvants. Mesh filters (with the different types and their uses), cartons, plates, cartridge, vacuum filters.

Ultrafiltration and Reverse Osmosis plant.

Pasteurization systems (6h + 2h Lab)

Pasteurization and sterilization plants.

The systems for packaged products: discontinuous and continuous autoclaves.

The installations for the pasteurization/sterilization of bulk product: pasteurizers for milk, the milk for sterilizers, sterilizers for fruit puree.

Drying equipment (2h)

Drying equipment / dehydration of vegetables and food products: drying chambers with controlled temperature and humidity, drying tunnel;

Drying plants for products in liquid form: spray dryer.



TEACHING METHODS

Theoretical lessons, Classroom tutorials, Laboratory tutorials, Technical visits.

EVALUATION METHODS

Final written exam, and oral exam.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Notes selected by reference texts is provided to students, supplemented with educational material produced by the teacher. All course material is regularly provided to students by sharing in a Dropbox folder.

INTERACTION WITH STUDENTS

At the beginning of the course, after describing the objectives, program and methods of verification, it is collected a list of students who intend to assiduously attend the course and participate in the laboratory demonstrations. The teacher provides the students the course material at the end of each lesson through shared folders. In addition to weekly reception, the instructor is available at all times for a contact with the students, both at his own studio and through his e-mail. Office hours: Monday from 15.00 to 17.00 and Wednesday from 9:30 am to 11:30 am at its office on the 3rd floor ex Dept. DITEC (Macchia Romana Campus).

EXAMINATION SESSIONS (FORECAST)¹

26/06/2019, 17/07/2019, 18/09/2017, 16/10/2019, 13/11/2019, 11/12/2019, 15/01/2020, 19/02/2020, 18/03/2020, 15/04/2020, 19/05/2020, 18/06/2020

EVALUATION BOARD

Prof. G.C. Di Renzo, (President), dott. Francesco Genovese (Member), Prof. G. Altieri (Member)

SEMINARS BY EXTERNAL EXPERTS YES ● NO □

FURTHER INFORMATION

¹ Subject to possible changes: check the web site of the Teacher or the Department/School for updates.