

Course Unit: 935031 – Dairy technology

Year 3 Semester 5 ISCED Code: 721 ECTS: 6.5

Type of Course Unit: Compulsory **Delivery Mode:** Face-to-face **Language of Instruction:** Portuguese

COURSE COORDINATOR: Nuno Bartolomeu Mendes Godinho de Alvarenga

HOURS OF WORK

TOTAL HOURS	Contact Hours								Hours in autonomous work
	Theory	Theory and practice	Practical and laboratory work	Field work	Seminar	Internship	Tutorial guidance	Other	
162.5	30		45				15		72.5

Prerequisites (if applicable): Not applicable.

LEARNING OUTCOMES (knowledge, skills and competence)

- 1 - To know the process of milk production in the mammary gland. Composition and structural organization of the major components of milk: fat globules, protein, lactose, water, minerals, vitamins, enzymes and other components.
- 2 - Understand the value of milk and dairy products in a nutritional and technological point of view.
- 3 - Understand the theoretical concepts of thermobacteriology, and be able to associate them with the technology used in the different heat treatments, including pasteurization, UHT and sterilization.
- 4 - To control the physical and biochemical mechanisms and the technology associated with the different manufacturing processes of dairy products, namely cheese, cream, butter, yogurt, drying and concentration of milk and whey.
- 5 - Apply the concepts of thermodynamics in dimensioning data for a heat exchanger.

CONTENTS

Theoretical

- Production, characterization and definition of milk. Milk versatility as a food, from the point of view nutritional, technological and social. Raw and transformed milk .
- Heat treatment, effects on milk components and thermobacteriology. Cream. Homogenization. Milk for consume: pasteurized, UHT and sterilized.
- Processed products: yogurt and fermented milk, evaporated milk and condensed and concentrated. Powdered milk, cream, butter and cheese. Byproducts: buttermilk, whey and curd. New Products.

Practices and tutorial

- Analysis of the raw materials and final products. Analyses of raw milk, pasteurized milk, UHT milk, yoghurt, cream, cheese and butter. Evaluation of laboratorial results, in accordance with legal and regulatory specifications.
- Low scale manufacturing: fresh cheese and ripening cheese, butter (includes cream production and churning).
- Thermodynamic concepts applied to dairy industries - dimensioning data for a heat exchanger of milk.

DEMONSTRATION OF THE CONTENTS COHERENCE WITH THE COURSE UNIT'S LEARNING OUTCOMES

The program of this course consists of three types of classes: theoretical classes, practical classes and tutorial classes. These different types of classes are interconnected.

In the theoretical classes the concepts and the theoretical fundamentals are explained, the technology and the legislation applied

to milk and milk products are explored.

In the tutorial classes, taught in the pilot plant, students apply the concepts acquired in the classroom and, in small groups, prepare dairy products.

In the laboratorial classes, students make a complete characterization of the dairy products made by them in the tutorial classes.

TEACHING METHODOLOGIES

The teaching methodologies comprise lectures, laboratory classes, which include theoretical-practical classes for problems resolution and lab classes, tutorials classes which include manufacture of dairy products in small scale in the pilot plant.

DEMONSTRATION OF THE COHERENCE BETWEEN THE TEACHING METHODOLOGIES AND THE LEARNING OUTCOMES

In the lectures are addressed topics such as the definition of milk, versatility: nutritional, social and technological. Milk and milk products as food. Production and use of the milk: raw milk, processed milk, other uses not specified. National and EU statistics. The Portuguese sector of milk and dairy products in the EU context. The physiology of milk production: udder structure, synthesis and animal food. Technical aspects of farm management. Milking. Refrigeration. Hygiene. Storage, transport and reception of milk.

Microbiology of milk and its derivatives: natural flora, pathogens and starter cultures. Industrial dairy engineering. Thermal processes and energy recovery. Water treatment, recovery of waste and effluent. Heat treatment, its effects on milk components, conservation. Cream. Homogenization. Drinking milk: pasteurized, UHT and sterilized. Milk compounds. Acidified and fermented milk products. Yogurt. Evaporated milk, concentrated and condensed. Milk powder. Derived products: cream, butter and cheese. By-products: buttermilk, whey and curd. New Products. Quality control and analytical. Analysis of raw materials, intermediate products and finished products. Hygiene and its control. Legislation and its applications for acquisition of raw materials and production of dairy products.

In lab and tutorial classes, themes described above are applied in context of dairy lab or in pilot plant. In the lab: 1) the students perform analysis of the raw materials and finished product. Analyses of raw milk, pasteurized milk, UHT milk, yoghurt, cream, cheese and butter. Results and discussion. Comparison of the results with legal and regulatory specifications. 2) Sampling: sample preservation, transport and sample preparation for analysis, 3) Authenticity indexes: density, fat, total solids and non-fat solids, cryoscopy. Freshness indexes: acidity (potentiometric and colorimetric), pH and rapid tests (boiling test, alcohol test and bromothymol test). Sporulated microorganisms (Weinzirl proof). Mastitis (Californian test, bromothymol). Technological indexes: Protein (Kjedahl, spectrophotometric methods) and casein (Walker technique, indirect methods). 4) Control of heat treatments: study of catalase, peroxidase: reactions of Dupouy and Storch, phosphatase by the methods of Gram Kay and Aschaffenburg and Mullen; 5) Milkoscan: determinations by the standard methods of protein, fat and lactose and introduction of the calibration curves in the equipment 6) coliforms in pasteurized milk. Evidence gases in UHT milk. 7) Problems resolution In pilot plant, the students prepare products in low scale manufacturing: fresh cheese and ripening cheese, butter (includes cream production and churning) and yogurt.

EVALUATION METHODS

The evaluation is performed by a final exam (50%) or, in alternative, two tests. The evaluation of practical classes is performed by two theoretical-practical tests (10% each) and evaluation of tutorial classes and practical classes is done by performing three group reports (10% each).

MAIN BIBLIOGRAPHY

Bylund G (1995) Dairy processing hand book, Tetra Pack Processing Systems AB, Lund, Sweden.

Walstra P, Wouters JTM & Geurts TJ (2006) Dairy Science and Technology. Taylor & Francis Group, LLC & CRC Press. L

Alais, C. (1985). *Ciência de la Leche. Principios de Técnica Lechera*. Versão Espanhola por D. António la Casa Godina. Editorial Reverté, S.A. Barcelona.

Alvarenga N, Ferro S, Almodôvar A & Canada J (2013) Shelf-life extension of cheese: frozen storage. In Handbook of cheese in health: production, nutrition and medical sciences. (Preedy et al. Eds), pp 87-101, Wageningen Academic Publ.

Fox PF, McSweeney PLH, Cogan TM & Guinee TP (2004) Cheese: Chemistry, Physics and Microbiology. (P. F. Fox, ed.), Vol. 1 & 2. Aspen Publishers, INC, Gaithersburg.