

COURSE OUTLINE

(1) GENERAL

SCHOOL	FOOD AND NUTRITIONAL SCIENCES		
ACADEMIC UNIT	FOOD SCIENCE AND HUMAN NUTRITION		
LEVEL OF STUDIES	BACHELOR OF SCIENCE		
COURSE CODE	3410	SEMESTER	4TH
COURSE TITLE	UNIT OPERATIONS IN FOOD PROCESSING		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>	WEEKLY TEACHING HOURS	CREDITS	
Lectures and problem-solving tutorials	5	5	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	Field of Science and Engineering		
PREREQUISITE COURSES:	Principles of Food Engineering		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://w1.aua.gr/etda/en/courses/unit-operations-in-food-engineering/		

(2) LEARNING OUTCOMES

<p>Learning outcomes</p> <p><i>The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.</i></p> <p>Consult Appendix A</p> <ul style="list-style-type: none"> • Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area • Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B • Guidelines for writing Learning Outcomes
<p>In this course the students will acquire knowledge on the unit operations employed in food processing plants, such as evaporators, dryers, heat exchangers, freezing and cooling systems among others. More specifically, the students will comprehend the operating principles (e.g. material and energy balances) of these unit operations, distinguish between the different types of unit operations, and describe their operation. Furthermore, the students will acquire skills and expertise in the</p>

description and analysis of the main mathematical equations that correlate the design and operating parameters of these unit operations with emphasis given on their estimation under different operating conditions. Upon successful completion of this course the student will be able to:

- Describe the various types of evaporators used in liquid food concentration and calculate the effect of operating parameters on the concentration of the final product, evaporation temperature, energy consumption, etc. The students will be also able to describe and elucidate on the different energy saving options in different evaporation applications
- calculate the properties of air using a psychrometric diagram and the required air flow rate in a hot air dryer. Describe the various types of dryers, distinguish the comparative advantages of each one and calculate the required drying duration of a food product in different applications
- comprehend and describe the cooling cycle and the corresponding equipment. To calculate the coefficient of performance of the equipment and the heat load of a refrigerator or a cold room
- describe and distinguish between the different types of heat exchangers employed in food processing και comprehend the basic operating principles. To calculate the heat exchanging area of a heat exchanger και comprehend the influence of different operating parameters
- Comprehend and describe the operation of bioreactors that are employed in the production of fermented foods and calculate the basic operating parameters. To comprehend and describe the mixing principles in tanks and bioreactors
- comprehend and describe extraction principles, understand the mass transfer phenomena involved and calculate the concentration of the extracted substance in the different streams as well as the required extraction time
- Comprehend and describe the alternative membrane separation systems and distinguish between reverse osmosis, ultrafiltration and microfiltration. To describe the separation processes via centrifugation and sieving as well as the milling and distillation systems and perform basic calculations of operating parameters

By participating in tutorial courses where the solution of relevant course problems will be taught, the students will acquire skills and expertise in the calculation of case-specific operating and design parameters for all unit operations employed in food processing. Alternative types of unit operations will be compared to select the optimal one for the development of highly efficient industrial processes producing food products of high quality and safety.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

<i>Search for, analysis and synthesis of data and information, with the use of the necessary technology</i>	<i>Project planning and management</i>
<i>Adapting to new situations</i>	<i>Respect for difference and multiculturalism</i>
<i>Decision-making</i>	<i>Respect for the natural environment</i>
<i>Working independently</i>	<i>Showing social, professional and ethical responsibility and sensitivity to gender issues</i>
<i>Teamwork</i>	<i>Criticism and self-criticism</i>
<i>Working in an international environment</i>	<i>Production of free, creative and inductive thinking</i>
<i>Working in an interdisciplinary environment</i>	<i>... ..</i>
<i>Production of new research ideas</i>	<i>Others...</i>
	<i>... ..</i>

- Search, analyze and synthesize data and information, using appropriate technologies
- Promote free, creative and inductive thinking
- Develop autonomous thinking and decision making
- Autonomous work

(3) SYLLABUS

1.	Introduction. SI units. Material and energy balances with emphasis on unit operations of food processing
2.	Liquid food concentration. Alternative evaporator systems. Single effect evaporators. Calculation of operating parameters
3.	Multiple effect evaporator systems. Energy consumption. Applications
4.	Psychrometry. Applications of air-water vapor systems. Cooling tower
5.	Drying theory. Alternative dryer types. Calculation of operating parameters. Applications
6.	Refrigeration cycle. Refrigeration systems. Calculation of operating parameters. Applications
7.	Freezing systems. Calculation of operating parameters. Applications
8.	Heat exchangers. Calculation of operating parameters. Applications
9.	Basic principles of bioreactor operation. Calculation of operating parameters.
10.	Separation with centrifugation and membrane-based processes (reverse osmosis, ultrafiltration, microfiltration). Size reduction and sieving.
11.	Liquid / liquid and solid / liquid extraction. Extraction with supercritical fluids.
12.	Batch distillation. Equilibrium distillation. Steam distillation. Distillation columns

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY <i>Face-to-face, Distance learning, etc.</i>	In class face-to-face teaching (power point presentations) Theory and problem solving Class notes	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	Solution of exercises that require the use of PC Using PC in lectures (power point, html) Teaching and tutorial support via the online platform e-class	
TEACHING METHODS <i>The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i>	Activity	Semester workload
	Lectures	39
	Tutorial courses presenting the solution of relevant course problems	26
	Practice at home in solving course problems	25
	Personal study	35
	Course total	125
STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple-choice</i>	I. Final written examination (100% of the final course grade in THEORY) that includes:	

<p>questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</p> <p>Specifically defined evaluation criteria are given, and if and where they are accessible to students.</p>	<ul style="list-style-type: none"> ➤ Multiple choice questions or Right/Wrong questions ➤ Short answer questions ➤ Judgment questions ➤ Descriptive, essay type questions ➤ Calculation problems <p>II. Final written examination (100% of the final course grade in LABORATORY) that includes:</p> <ul style="list-style-type: none"> ➤ Calculation problems ➤ Judgment questions
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(5) ATTACHED BIBLIOGRAPHY

<p>- Suggested bibliography:</p> <ol style="list-style-type: none"> 1. ΠΑΡΑΔΟΣΕΙΣ ΜΗΧΑΝΙΚΗΣ ΤΡΟΦΙΜΩΝ, Μέρος II. Σ. ΓΙΑΝΝΙΩΤΗΣ. ΓΠΑ, 2011. 2. ΒΑΣΙΚΕΣ ΔΙΕΡΓΑΣΙΕΣ ΧΗΜΙΚΗΣ ΜΗΧΑΝΙΚΗΣ 6Η ΕΚΔΟΣΗ McCABE, SMITH & HARRIOTT (μετάφραση) ΕΚΔΟΣΕΙΣ ΤΖΙΟΛΑ, 2002. 3. SOLVING PROBLEMS IN FOOD ENGINEERING, STAVROS YANNIOTIS, Springer, 2008. 4. INTRODUCTION TO FOOD ENGINEERING, P.R. SINGH and D.R. HELDMAN, 5TH Edition, Academic Press, 2014. Ελληνική μετάφραση: Επιστημονικές Εκδόσεις Παρισιάνου Α.Ε., Αθήνα, 2019. <p>- Relevant peer-reviewed scientific research journals:</p> <ol style="list-style-type: none"> 1. Journal of Food Engineering (Elsevier) 2. Innovative Food Science and Emerging Technologies (Elsevier)
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