COURSE OUTLINE

1. GENERAL

SCHOLL	AGRICULTURAL SCIENCES		
ACADEMIC UNIT	FOOD SCIENCE & TECHNOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**FST_301**	**SEMESTER**	3rd
COURSE	FOOD ENGINEERING I		

INDEPENDENT TEACHING ACTIVITIES *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*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	
Laboratory exercises	2	
TOTAL	**5**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at 4.		

COURSE TYPE *Background, General knowledge, Field of science, Skills development*	*Compulsory* *Field of science, Skill sevelopment*
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.upatras.gr/

2. LEARNING OUTCOMES

Learning outcomes

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.

Consult Appendix A

- *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*

The course aims to:

- Acquire knowledge in the basic engineering principles governing the food processing processes
- The recognition, understanding and interpretation of the physical phenomena associated with these processes
- The ability to mathematically describe and evaluate the parameters related to these processes
  The ability to apply the acquired knowledge to industrial-type processes.

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?

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

Search, analysis and synthesis of data and information, using the necessary technologies

Decision making

Autonomous work

Project planning and management

Teamwork

Exercise criticism and self-criticism

Promotion of free, creative and inductive thinking

3. SYLLABUS

The concept of equilibrium in a system in permanent and non-permanent state. Principles of conservation of mass and energy

Constructing and solving mass balances in simple and complex processes in the absence or presence of reactions.

Phase diagrams and equilibria. Gibbs Law.

Humidity and psychrometric charts.

Internal energy, enthalpy, heat and work. Steam tables. Energy balances.

Fluid Statics. Hydrostatic balance. Absolute and gauge pressure.

Flow Phenomena. Shear stress. Viscosity. Newton's law. Types of rheological behavior. Laminar and Turbulent Flow. Reynolds number. Boundary layers in walls and ducts. Flow around submerged bodies. Drag coefficient.

Flow equations. Average velocity, momentum and kinetic energy in one-dimensional flow. Continuity equation. Equation of motion. Flow over an inclined plate. Bernoulli equation. Calculation of flow from a nozzle.

Incompressible flow in pipes. Cutaneous friction. Fanning coefficient of friction. Non-circular conductors. Velocity distribution in laminar and turbulent flow. Hagen-Poiseuille equation.

Coefficients of friction for smooth and rough ducts. Frictions due to reduction or enlargement of cross-section and presence of components. Pump power.

Types and categories of pressure, fluid flow and tank level measuring instruments.

Heat transfer mechanisms. Treatment. Fourier's law. Thermal conductivity. Synagogue.

Law of cooling. Heat transfer coefficient. Thermal radiation. Stefan-Boltzmann law. Emission and absorption of radiation. Thermal balance.

Education in a permanent state. One-dimensional treatment in flat, cylindrical and spherical arrangement. Conduction through multiple layers in series. Combined treatment-convention. Total heat transfer coefficient. Critical thickness of cylindrical insulation.

Education in a non-permanent state. Biot number. Thermal diffusivity. Fourier number. Spotted capacity analysis. Transient cooling diagrams in plate, cylinder, sphere and complex geometries.

Synagogue. Forced Synagogue. Nusselt, Prandtl numbers. Thermal boundary layer. Heat transfer equations for laminar and turbulent flow over a plate and in ducts. Natural convection. Grashof number. Phase change convection. Condensation and boiling.

Heat transfer devices. Alternators and types of alternators. Heat transfer equation in a tubular exchanger. Mean logarithmic temperature difference. Correction factor for compound alternators. Alternator efficiency. NTU method. Total heat transfer coefficient present.

Types and categories of temperature measuring instruments. Steam transport networks and accessories. Steam traps. Steam reducers.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Lectures using PowerPoint presentations Laboratory training Posting educational material in the e-class
ΟΡΓΑΝΩΣΗ ΔΙΔΑΣΚΑΛΙΑΣ *Περιγράφονται αναλυτικά ο τρόπος και μέθοδοι διδασκαλίας.* *Διαλέξεις, Σεμινάρια, Εργαστηριακή Άσκηση, Άσκηση Πεδίου, Μελέτη & ανάλυση βιβλιογραφίας, Φροντιστήριο, Πρακτική (Τοποθέτηση), Κλινική Άσκηση, Καλλιτεχνικό Εργαστήριο, Διαδραστική διδασκαλία, Εκπαιδευτικές επισκέψεις, Εκπόνηση μελέτης (project), Συγγραφή εργασίας / εργασιών, Καλλιτεχνική δημιουργία, κ.λπ.*	

Δραστηριότητα	***Φόρτος Εργασίας Εξαμήνου***
Lectures	39
Literature study and analysis	50
Laboratory exercises	20
Writing laboratory exercises	16
Total Course ***(25 workload hours per credit unit)***	***125***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice 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* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students*	It is carried out based on the following criteria (combined or not) depending on the number of students who will participate in the course. • End-of-semester written exam with development questions, short answer questions and/or multiple choice questions, or a combination of the above • Evaluation of laboratory work

5. ATTACHED BIBLIOGRAPHY

1. Ch. N. Lazaridis, Food engineering, 2nd Edition, Publisher Giachoudi, Thessaloniki, 2007.
2. R. P. Singh, D. R. Heldman, Introduction to Food Engineering, Academic Press, 2003
3. Himmelblau D.M., Riggs J.B., Basic Principles and Calculations in Chemical Engineering, 7th Edition, Publisher Tziola, Thessaloniki, 2006
4. P.G.Smith, Introduction to Food Process Engineering, Kluwer Academic/Plenum Publishers, 2003
5. W. L. McCabe, J. C. Smith, P. Harriot, Basic Physical Engineering Processes, 6th Edition, Publisher Tziola, 2001

Related Scientific Journals:

- Journal of Food Engineering (Elsevier)
- Journal of Food Process Engineering (Wiley)
- Food Engineering Reviews (Springer)
- International Journal of Food Engineering and Technology (Science PG)