VELEUČILIŠTE U KARLOVCU
Karlovac University of Applied Sciences

COURSE SYLLABUS

General information

Course title:	THERMAL OPERATIONS AND MACHINES IN THE FOOD INDUSTRY
ISVU course code:	266809
Course instructor:	
Course assistant:	
Study programme and specialization in which the course is taught:	Professional undergraduate study of food technology
ECTS credits:	5.0
Semester of the course execution:	IV.
Exam prerequisites:	Mechanical operations and machines in the food industry Basics of food technologies
Course objectives:	The aim of the course is to acquaint students with the basics of food technology and the production of food products by understanding thermal operations and the basics of engineering and design with a special emphasis on economic aspects.

Course structure

Teaching mode	**Number of contact hours per semester:**	**Student's requirements per teaching mode**
Lectures:	30	Attendance at lectures; 80%
Exercises (auditory, linguistics):	30	Attendance at exercises; 80%
Exercises (laboratory, practical):		
Field work:		
Other:		
TOTAL:	60	

Monitoring of students' work and knowledge evaluation during the course

OUTCOMES		**Colloqu-ium 1**	**Colloqu-ium 2**	**Total**	**Pass**	**Time frame for the recognition of the outcome**
Outcome 1	Describe heat transfer with practical examples and connect transfer methods.	20%		20%	10%	Until the end of the academic year
Outcome 2	Recognize the method of heat transfer in exchangers, illustrate devices and calculate heat transitions.	16%		16%	8%	Until the end of the academic year
Outcome 3	Explain the natural phenomenon of the transition from a gaseous to a liquid state of a fluid and calculate the mass of water	16%		16%	8%	Until the end of the academic year

	required for condensation.					
Outcome 4	Describe the concentration of the product using evaporation and boiling.		16%	16%	8%	Until the end of the academic year
Outcome 5	Discuss the cooling technologies of raw materials and products of animal and vegetable origin, distinguish between cooling machines in industry and calculate the heat balances of refrigerators.		16%	16%	8%	Until the end of the academic year
Outcome 6	Choose the method of freezing raw materials according to thermal capacity and choose freezing devices based on the freezing process.		16%	16%	8%	Until the end of the academic year
Total % grade points		52	48	100	50	
Share in ECTS		2,7	2,3	5		

Knowledge evaluation on exams

Exam prerequisites					
OUTCOMES		**Written exam**	**Oral exam**	**Total**	**Pass**
Outcome 1	Describe heat transfer with practical examples and connect transfer methods.	10%	10%	20%	10%
Outcome 2	Recognize the method of heat transfer in exchangers, illustrate devices and calculate heat transitions.	8%	8%	16%	8%
Outcome 3	Explain the natural phenomenon of the transition from a gaseous to a liquid state of a fluid and calculate the mass of water required for condensation.	8%	8%	16%	8%
Outcome 4	Describe the concentration of the product using evaporation and boiling.	8%	8%	16%	8%
Outcome 5	Discuss the cooling technologies of raw materials and products of animal and vegetable origin, distinguish between cooling machines in industry and calculate the heat balances of refrigerators.	8%	8%	16%	8%

Outcome 6	Choose the method of freezing raw materials according to thermal capacity and choose freezing devices based on the freezing process.	8%	8%	16%	8%
Total % of grade points		50	50	100	50
Share in ECTS		2,5	2,5	5	

Review of units per week with associated learning outcomes

Week	Lecture course content and learning outcomes:	Outcome	Exercises course content and learning outcomes:	Outcome
1.	Heat transfer by conduction.	I1.	Numerical problems: Heat transfer by conduction.	I1.
2.	Heat transfer by convection.	I1.	Numerical problems: Heat transfer by convection.	I1.
3.	Heat transfer by radiation.	I1.	Numerical problems: Heat transfer by radiation.	I1.
4.	Types of heat exchangers used in food industries.	I2.	Numerical problems: Operation of DC heat exchangers.	I2.
5.	Types of heat exchangers according to technical performance.	I2.	Numerical tasks: Operation of countercurrent heat exchangers.	I2.
6.	Technological operation of matching and restrictions.	I2.	Numerički zadaci: Rad uparivača topline.	I3.
7.	Direct and counter-current heat exchangers and technological operation of spray drying.	I2.	Numerical problems: Operation of the heat exchanger.	I3.
8.	Types of couplers according to technical performance.	I2.	Numerical tasks: Operation of the condensation device - condenser.	I4.
9.	Evaporation by boiling and evaporation.	I3.	Numerical problems: Examples of condensation without a condensation device.	I4.
10.	Technological operation of condensation and condensers.	I4.	Numerical tasks: Calculation of steam production plant capacity.	I4.
11.	Technological cooling operation.	I5.	Numerical problems: Cooling effect.	I5.
12.	Cooling methods and cooling devices.	I5.	Numerical tasks: Refrigeration cycle.	I5.
13.	Refrigeration devices according to performance and equipment for cold storage.	I5.	Numerical tasks: Refrigeration devices, equipment and balance of cold stores.	I5.
14.	Technological freezing operation and freeze drying (lyophilization).	I6.	Numerical tasks: Calculations based on operational cooling measurement data.	I6.
15.	Construction of cooling devices for cooling and freezing.	I6.	Numerical tasks: Calculations based on operating measurement data and construction.	I6.

References (compulsory / additional)

compulsory

1. Ergović Ravančić, M. Tehnološke operacije-zbirka zadataka. Veleučilište u Požegi. Požega, 2018.
2. Galović, A. Termodinamika II, IV. izdanje. Fakultet strojarstva i brodogradnje, Zagreb. Zagreb, 2007.
3. Ibarz, A., Barbosa-Canovas, Gustavo V. Unit operations in Food ennginering. CRC Press – London. London, 2004.

additional

1. Kostelić, A. Nauka o toplini, tablice I dijagrami, Školska knjiga, Zagreb. Zagreb, 1992.
2. Mitrović-Kessler, E. Prijenos tvari i energije- skripta. Tehnološki Fakultet – Split, Split. 1995.
3. Stanišić, S. Tehnološke operacije II. Tehnološki Fakultet – Novi Sad, Novi Sad. 1988.
4. Tahmaz, J. Enkapsulacijske tehnike u prehrambenom inženjerstvu. Dobra knjiga. Sarajevo, 2019.