No._____of _____ **USAMV form 0703030105**

SUBJECT OUTLINE

1. Information on the programme

1.1. Higher education institution	**University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca**
1.2. Faculty	**Food Science and Technology**
1.3. Department	**Food Engineering**
1.4. Field of study	**Food Engineering**
1.5.Cycle of study[1]	**Bachelor**
1.6.Specialization/ Study programme	**Food Engineering (IPA)**
1.7. Form of education	**Full time**

2. Information on the discipline

2.1. Name of the discipline	**Sugar processing**							
2.2. Course coordinator	**Vlad Mureşan, PhD, habil., Associate Professor**							
2.3. Seminar/ laboratory/ project coordinator	**Georgiana Smaranda Marţiş, PhD, Assistant Professor**							
2.4. Year of study	**III**	2.5. Semester	**V**	2.6. Type of evaluation	summative	2.7. Discipline status	Content[2]	DS
							Compulsoriness[3]	DI

3. Total estimated time (teaching hours per semester)

3.1. Hours per week – full time programme	3	out of which: 3.2. lecture	2	3.3. seminar/ laboratory/ project	1
3.4.Total number of hours in the curriculum	42	Out of which: 3.5.lecture	28	3.6.seminar/laboratory	14
Distribution of the time allotted					hours
3.4.1. Study based on book, textbook, bibliography and notes					11
3.4.2. Additional documentation in the library, specialized electronic platforms and field					7
3.4.3. Preparing seminars/ laboratories/ projects, subjects, reports, portfolios and essays					8
3.4.4.Tutorials					3
3.4.5.Examinations					4
3.4.6. Other activities					

3.7. Total hours of individual study	33
3.8. Total hours per semester	75
3.9. Number of credits[4]	3

4. Prerequisites (if applicable)

4.1. curriculum-related	Operations and equipment in the food industry; Transfer phenomena; Raw vegetable materials; Food chemistry; Mathematics; Food biochemistry; Food microbiology.
4.2. skills-related	The student should have knowledge of Food Industry unit operations and machines, as well as knowing the physical and chemical properties of sugars.

5. Conditions (if applicable)

5.1. for the lecture	Room with projector and internet connection. The course is interactive; students can ask questions regarding the content of the statement. Academic discipline requires compliance of starting time and end of the course. There are not allowed any other activities during the lecture, mobile phones to be closed.

5.2. for the seminar/ laboratory/ project	For practical works each student will carry out an application / technological computation / chemical analysis specific to Sugar technology. Academic discipline is imposed for the duration of works. Specially designed laboratory (equipped with specific glassware, oven, balance, refractometer, polarimeter); Confectionery Pilot Plant.

6. Specific competences acquired

Professional competences	C3.2. Explaining and interpreting the principles and methods used in technological processes in the food chain C2.3. Application of basic engineering principles and methods for solving technological problems in the agri-food chain
Transversal competences	CT1 Apply strategies for perseverance, rigor , efficiency and responsibility in work , punctuality and personal accountability for its performance , creativity, common sense, analytical and critical thinking , problem solving, etc., based on principles, norms and values code of professional ethics from food industry;

7. Course objectives (based on the list of competences acquired)

7.1. Overall course objective	To acquire the knowledge concerning the raw materials, production technologies, equipment and facilities involved in sugar production (beet derived).
7.2. Specific objectives	Knowledge of quality parameters of sugar beet and sugar finished product; Knowledge of operations and operating principles of the equipment from sugar factory; Using and understanding the methods, analysis techniques, applications and technological computations from extraction technology (sugar) field; Interpretation of results obtained by analysing the raw materials, intermediate and finished products from sugar industry.

8. Content

8.1.LECTURE	Teaching methods	Notes
Number of hours – 28		
Ch. I General, physical and chemical properties of sucrose. 1.1. General notions. 1.2. Physical and chemical properties of sucrose	Lecture, explanation, conversation, debate	1 Lecture
Ch. II The technological process of manufacturing sugar from beet. 2.1. Technological scheme of sugar beet processing into sugar. Main technological operations 2.2. Raw materials for sugar production 2.2.1. Sugarcane 2.2.2. Sugar beet. Chemical composition. Quality indices.		
2.3. Preparing beet sugar for processing 2.3.1. Harvesting 2.3.2. Reception, storage, transport the beet. 2.3.3. Washing beet. Aim. Washing machines. Chlorination beet; 2.3.4. Water transport and washing. Recirculated water. Decanters; 2.3.5. Beet cutting machines. Beet elevator. The weight of beet	Lecture, explanation, conversation, debate	1 Lecture
2.4. Obtaining raw sugar solution (diffusion juice) 2.4.1. Operation for beet cutting in cossets. Aim. Cutters	Lecture, explanation, conversation, debate	1 Lecture

beet. 2.4.2. Cossets quality 2.4.3. Extracting sugar- Cossets diffusion 2.4.4 Diffusion. Generalities. Theoretical considerations; 2.4.5. Installations for diffusion. Battery diffusion. 2.4.6. The continuous diffusion plants 2.4.7. Products and control of the diffusion operation. Diffusion. Byproducts. Drain waters. The dry matter content, sugar, acidity of the diffusion juice, pulp, water diffusion.	Prelegere, explicaţie, conversaţie, dezbatere	2 Lectures
2.5. Diffusion Juice treatment () 2.5.1. The composition and the purification need of diffusion juice. Methods for purification. Pre-liming. Liming. Saturation I. II. Decalcification ion exchange. Sulfitation thin juice. Filtration liquors. Purification schemes.	Lecture, explanation, conversation, debate	2 Lectures
2.6. Obtaining white crystallized sugar 2.6.1. Concentration of thick juice 2.6.1.1. Generalities. The purpose of the evaporation. Devices evaporation.	Lecture, explanation, conversation, debate	2 Lectures
2.6.1.2. Multiple effect evaporation. Principles. Heat transmission conditions. Calculation of evaporation station. 2.6.1.3. Changes that occur during evaporation. 2.6.2. Boiling and crystallization 2.6.2.1. The purpose of boiling and crystallization; 2.6.2.2. Sugar crystallization. The formation and the growth rate of the crystals of sugar. Influencing factors. Crystallization schemes.	Lecture, explanation, conversation, debate	2 Lectures
2.6.2.3. Boiling apparatus vertical, horizontal continuous operation. 2.6.3. Centrifuging thick mass. Obtaining white crystal sugar.	Lecture, explanation, conversation, debate	1 Lecture
2.6.3.1. Drying, sifting, weighing and storing sugar; 2.7. Refining of raw sugar 2.7.1. Boiling and crystallization of the final product. 2.7.2. Sugar refining. Working Schemes. 2.7.3. Obtaining sugar cubes	Lecture, explanation, conversation, debate	1 Lecture
Ch. III Preparation of auxiliary materials 3.1. Obtaining milk of lime and gas saturation. 3.2. Obtaining the sulfur dioxide **Ch. IV By-products from sugar production** 4.1. Exhausted pulp. Dry silage. 4.2. Molasses. Chemical composition. Loss of sugar in the molasses. The theory of formation and use of molasses.	Lecture, explanation, conversation, debate	1 Lecture

8.2. PRACTICAL WORK **Number of hours – 14**		
Technological applications to the diffusion operation. Determination of dry matter, sucrose and diffusion purity.	Debate, explanation, experiment, conversation, explanation	2 Practical works
Technological applications to the diffusion purification operations. Determination of dry matter, sucrose and fine-grained purity.	Debate, explanation, experiment, conversation, explanation	2 Practical works

Technological applications to evaporation and boiling and crystallization operations. Determination of the polarization of intermediate and finished product sugar. Determination of purity and non-sugar content. Verification of knowledge.	Debate, explanation, experiment, conversation, explanation	2 Practical works 1 Practical work

Compulsory bibliography:

1. Racolța E., *Tehnologia Zahărului (Curs didactic)*, Editura AcademicPres, Cluj-Napoca, 2013.
2. Muresan V, *Tehnologii Extractive – Zahăr* (Îndrumător de lucrări practice), Editura MEGA, Cluj-Napoca, 2016. ISBN 978-606-543-759-3.
3. Racolţa Emil, Marta Hodrea, Teodora Șchiop, "*Îndrumător de lucrări practice pentru produse zaharoase"*, Ed.Risoprint, 2008;
4. Racolţa Emil, *"Tehnologii generale în industria alimentară*", " *Aplicatii si calcule tehnologi*ce" Ed.Risoprint, 2007;
5. "*Manualul inginerului de industria alimentara*", Ed. Tehnica Bucuresti, 2002;
6. Banu C., "*Progrese tehnice, tehnologice şi ştiinţifice în industria alimentară*", Ed. Tehnică,Bucureşti, 1993;
7. Dominica Culache, Vasile Platon, "*Tehnologia zahărului*", Ed. Tehnică, Bucureşti, 1987;
8. "*Îndrumar pentru industria alimentară*", Lexicon, Ed. Tehnică, 1987
9. Luca Gh., "*Probleme de operaţii şi utilaje în industria alimentară*", Ed. Tehnică,Bucureşti, 1978;

Optional bibliography:

1. *Adriana -Paula David, Emil Racolta, "Utilajul si tehnologia de obtinere a zaharului", Ed. Risoprint, Cluj-Napoca 2010;*
2. *Bratu Em. A., Operaţii şi utilaje în industria chimică, Ed. Tehnică, Bucureşti, 1970*

9. Corroborating the course content with the expectations of the epistemic community representatives, of the professional associations and of the relevant employers in the corresponding field

Course content is consistent with the demands of specific national professional associations; the teaching staff regularly attend international fairs and undertake field visits on food industry specific establishments (sugar, glucose, sugar products, starches)

10. Assessment

Type of activity	10.1. Assessment criteria	10.2. Assessment methods	10.3. Percentage of the final grade
10.4. Lecture	Knowledge acquired; level of understanding; Solving specific problems related to sugar technology.	Exam	70%
10.5. Seminar/Laboratory	Making an application specific to sugar industry; Technological computation specific to sugar industry operations by applying full or partial material balance equations; Description of specific analytical methods specific to sugar industry.	Continuous assessment of skills for making applications / technological computation and analytical methods specific to sugar technology.	30%
10.6. Minimum performance standards			
Knowledge of quality indices of raw material and finished product. Knowledge of technological general scheme for obtaining sugar from sugar beets.			

[1] Level of study- to be chosen one of the following - Bachelor/Post graduate/Doctoral

[2] Course regime (content) – for bachelor level it will be chosen one of the following - **DF** (fundamental subject), **DD** (subject in the domain), **DS** (specific subject), **DC** (complementary subject).

[3] Course regime (compulsory level) - to be chosen one of the following - **DI** (compulsory subject), **DO** (optional subject), **DFac** (facultative subject)

[4] One ECTS is equivalent with 25-30 de hours of study (didactical and individual study).

Filled in on
07.09.2021

Course coordinator
Vlad Mureșan, PhD, habil., Associate Professor

Laboratory work/seminar coordinator
Georgiana Smaranda Marțiș, PhD, Assistant Professor

Subject coordinator
Vlad Mureșan, PhD, habil., Associate Professor

Approved by the Department on
22.09.2021

Head of the Department
Sevastița Muste, PhD, habil., Professor

Approved by the Faculty Council on
28.09.2021

Dean
Elena Mudura, PhD, habil., Professor