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| **Title and Code** of the subject:**Unit operations in food processing I. MTBE7013A** | **ECTS Credit Points: 5** |
| **Type** of the subject: compulsory |
| **Ratio of theory and practice: 50/50** (credit%) |
| **Type and number of classes per semester**: 28 hours lecture and 28 hours practice per **semester** Number of teaching hours / week : 2+2 (lecture and practice) |
| **Type of exam**: exam (written test) |
| **Subject in the curriculum:** semester III |
| Preliminary requirements:- |

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| **Summary of content - theory**:  |
| Within the framework of Unit operations in food processing the flow of fluids, separation, homogenization and transport processes are educated. In the lectures mathematical description, equipment and conditions of the flow of fluids, separation processes, homogenization processes and transport (solid agglomerations) processes operations are discussed.**Schedule:**1. General description of the flow of fluids2. Reynolds number, equivalent pipe diameter, principle of continuity3.Bernoulli equation4. Fluid transport (pumps, fans, compressors)5. General description of the mechanical separations, gravity sedimentation6. Centrifugal sedimentation, types of centrifuges, cyclones, hydrocyclones7. Filtration, filtering equipments8. Pressing, pressing machines9. Homogenization, mixing, mixers10. Emulsification, emulsifying equipments11. Crushing, crushers12. Pounding, pounding machines13. Fluidization14. Pneumatic transport |
| **Summary of content - practice**: |
| In the frame of the exercise classes equations, methods and practical mathematical modells are described. In the practice application of fundamental laws and equations takes place with different mathematical models and equations.**Schedule:**1. Practical calculation tasks in the topics of Reynolds number, equivalent pipe diameter, principle of continuity
2. Applications of Bernoulli equation in the food industry calculations I.
3. Applications of Bernoulli equation in the food industry calculations II.
4. Calculations of the fluid transport
5. Practical calculation tasks in the topics of mechanical separations, gravity sedimentation
6. Practical calculation tasks and food industry applications of the centrifugal sedimentation
7. Practice Test I.
8. Food industry practice examples and calculations of homogenization and mixing
9. Food indsutry practice examples of emulsifying-, crushing equipments
10. Food indsutry practice examples of pounding machines
11. Practical calculation tasks in the topics of fluidization I.
12. Practical calculation tasks in the topics of fluidization II.
13. Practice Test II.
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| **Literature, handbooks in English**  |
| 1. Food Process Engineering and Technology. 2nd Edition. Authors: Zeki Berk. Hardcover ISBN: 9780124159235. eBook ISBN: 9780124159860
2. Unit Operations in Food Processing, Second Edition 2nd Edition by R.L.Earle eBook ISBN: 9781483293103
3. Introduction to Food Engineering, Fifth Edition (Food Science and Technology) 5th Edition by R Paul Singh (Author), Dennis R. Heldman (Author)  ISBN-13: 978-0123985309
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| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**
* The student knows and understands the principles, machines, equipment and instruments of widely understood food industry operations, as well as their operation in practice.
1. **Skills:**
* The student is able to perform sub-tasks in the development and the design of technological systems, and in the development of new processes and products.
1. **Attitude:**
* The student is susceptible to acquire the knowledge needed to work with devices and equipment related to food processing.
1. **Autonomy and responsibility:**
* The student solves professional problems in the field of food industry independently or in cooperation with others, with individual responsibility and observance of ethical standards of the profession.
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| **Responsible lecturer: Prof. Dr. Róbert Béla Kovács, professor, PhD** |
| **Other lecturer(s): István Fekete, teacher** |

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| **Terms of course completion:** |
| 1. During the semester, the student may write 3 tests containing theoretical questions, based on which he/she may get an offered mark for the exam. In addition, students have to write 2 tests containing questions connected to the topics of the practice (seminar), and they will get the mark for the practice (seminar) based on these tests.
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| **Form of examination:** |
| Written exam |
| **Requirement(s) to get signature:** |
| Participate on the practices and successful practice tests (min 60%). |

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| **Exam questions:** |
| 1. What does production technology mean?
2. What does unit operations mean generally?
3. What are the effects of unit operations on raw material?
4. Classify unit operations according to physical influences!
5. What does general unit operation mean? And write 4 examples!
6. List what kinds of sub-groups you know within the special operations. Write two examples for each group!
7. Classify unit operations according to transport processes!
8. Explain the following definitions in 4-5 sentences: semi-empirical equations, dimensionless expressions, equivalent substitution principle.
9. In what areas can we apply the equivalent substitution principle?
10. List the SI base units with name and symbol!
11. Write 4 examples (name and symbol) from SI- Derived units expressed in terms of Base units
12. Write 4 examples (name and symbol) from SI-derived units with Special Names.
13. Show the incompressible and compressible fluids with 4-5 sentences!
14. Show the Perfect fluids with 4-5 sentences!
15. Show the Newtonian fluids with 4-5 sentences!
16. Show the Anomalous (abnormal) fluids with 4-5 sentences!
17. Show the following sub groups of anomalous fluids 4-5 sentences:
	1. Pseudoplastic
	2. Dilatant
	3. Bingham plastic
	4. Thixotropic
	5. Rheopectic
18. What do the following elements means: fluid, flow cross section, flow pattern.
19. How can you calculate pressure?
20. How does the Manometer and Venturi meter work? Show it briefly!
21. What kinds of opportunities are there to create differentail pressure!
22. Write down the two types of flow and show them briefly!
23. Show the different types of flow parameters (pump capacity, total developed head, volumetric- and mass flow rate).
24. Write the how we can determine volumetric flow rate!
25. Describe how rotameters operate with 4-5 sentences.
26. Write down the advantages and disadvantages of rotameter!
27. Show the factors that influence Pump Capacity!
28. Determine the definition of flow velocity (definition, symbol, unit, calculations)
29. What does viscosity mean in fluids? (5-6 sentences)
30. Show the different types of viscosity (dinamic, kinematic, relative)
31. What does apparent viscosity mean in connection with fluids?
32. What effects does temperature have on the viscosity of Newtonian fluids?
33. Describe what boundary layer means in flowing fluids of a tube.
34. How can we reduce the formation of boundary layer?
35. List some parameters that are important regarding flowing fluids!
36. Describe the parameters that affect the type of flow!
37. Describe the Reynolds’s experiments with 5-6 sentences!
38. How can we calculate the Reynolds number?
39. When we want to use the equivalent pipe diameter in calculations how can we calculate it?
40. Describe the principle of continuity with 5-6 sentences and write the most important conslusion of the principle of continuity!
41. Describe the following definitions with 4-5 sentences: pressure-, kinetic-, and potential energy.
42. Describe the Definition of Bernoulli’s law
43. How we can calculate the following: flow rate from tank, wash out period
44. Describe the parameters that affect friction loss in pipes!
45. How can we calculate the Darcy-Weisbach equation?
46. Describe the methods of determining the Darcy Friction Factor!
47. What does Equivalent length mean?
48. Describe the benefits of size reduction in food processing.
49. Show the classification of size reduction process!
50. What kind of forces do we use in Size reduction (force+shematic diagram, principle, example of equipmnet)?
51. Describe the mechanism of size reduction with 4-5 sentences.
52. What depends on the energy required for size reduction?
53. Write down the energy for size reduction in food processing with 4-5 sentences. Describe the mathematical formula for calculating energy.
54. What does the Kick’s Law mean in the size reduction?
55. What does the Rittinger’s Law mean in the size reduction?
56. Describe how the crushers equipment operates and write down which types you know!
57. Describe how the hammer mills equipment operates in the size reduction of the food industry with 6-7 sentences.
58. Describe how the attrition mills equipment operates in the size reduction of the food industry with 6-7 sentences.
59. Describe how the tumbling mill equipment operates in the size reduction of the food industry with 6-7 sentences.
60. Write down which types of cutting machine you know!
61. What does homogenization mean in food insutry?
62. What types of blades do you know for high-speed mixers?
63. Describe how the pressure homogenizers equipments in the size reduction of food industry with 6-7 sentences.
64. Describe the colloid mills machine with 4-5 sentences.
65. Describe the ultrasonic homogenizers machine with 4-5 sentences.
66. What does emulsification mean and show the types of emulsifying equipment!
67. Describe the four groups in the mechanical separation!
68. Describe how you can calculate the centrifugal force of a partical?
69. What does the size of the centrifugal force depend on?
70. Describe the working of the centrifugal separation with 4-5 sentences.
71. Describe how the decanter centrifuge equipment operates in the centrifugal separation of the food industry with 6-7 sentences.
72. Show briefly the following machines: tubular cetntrifuges, disc-bowl- and the basket centrifuges.
73. What is the purpose of the filtration!
74. What does the surface and depth filtration means?
75. Write some examples of application of filtration in food processing!
76. What do the dead-end filtration and the cross-flow filtration mean?
77. How can you calculate the rate of filtration?
78. What does „filter aids” mean in filtartion, why and when is it necessary?
79. Describe the three categories of barrier filters and write down briefly how these operate!
80. What does expression mean in the food industry?
81. Describe some possibilities, where we can use expression in the food industry!
82. Describe the pressures used in various applications of expression!
83. What does fluidization mean in the food industry, why and when is it necessary?
84. What does pneumatic transport mean in the food industry, why and when is it necessary?
85. Show briefly the pneumatic transport machines!
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