

## SYLLABUS

**1. Course title:**

Optimization of water consumption in industry

**2. Code:****3. Cycle of study:**

1

**4. ECTS credits:**

3

**5. Type of course:** Mandatory  Elective**6. Prerequisites:****7. Class restrictions:**

No restrictions

**8. Duration / semester:**

1

6

**9. Weekly contact hours:**

9.1. Lectures:

2

9.2. Seminars:

0

9.3. Laboratory/Practice classes:

1

**10. Faculty:**

Faculty of Technology

**11. Department/study program:**

Chemical Engineering and Technologies / Ecological Engineering

**12. Lecturer:**

Elvis Ahmetović, Full Professor

**13. Lecturer's e-mail:**

elvis.ahmetovic@untz.ba

**14. Web site:**

www.tf.untz.ba

**15. Course aims:**

Course aims are to:

- understand basic knowledge about synthesis and optimization of water networks in process industry,
- understand, critically analyze and solve water network problems using mathematical programming and present the results,
- understand the importance of the use of computer-aided tools for water integration,
- improve written and verbal communication skills.

**16. Learning outcomes:**

After completing the course and the teaching obligations students will be able to:

- use and analyze the available literature in order to obtain the necessary information,
- understand the basics of rational use/optimisation of water from aspects of economy and sustainability of process,
- solve selected problems of water network synthesis, assess the results of the calculation and draw conclusions,
- sketch the integrated process water network with a minimum consumption of fresh water and minimal generation of waste water,
- present the results in written and verbal forms.

**17. Course content:**

Presentation of syllabus. Introduction to optimization of water consumption in the industry. Needs of the technological process for process water, water for steam generation and cooling water. Recirculation system of cooling water in the process. Analysis of water consumption. Principles of reuse, regeneration and recirculation of water. Centralized and distributed system of wastewater treatment. Systematic methods for optimization of water consumption in industry. Synthesis of water-using process units. Synthesis of wastewater treatment units. Synthesis of integrated network of process and treatment units. Development of water network optimization models. Selection of the objective function and model constraints. Solution strategies of water network optimization models. Optimal water network design. Illustrative examples of water consumption before and after optimization.

**18. Learning methods:**

Lectures, laboratory (computer) exercises, seminars, consultations.

**19. Assessment methods:**

For checking the acquired knowledge in the course, written and oral examinations are used. During the semester students will be assigned with seminar works that should be completed and submitted by the end of the semester. Assessment is performed through the oral presentations of seminar works. Written examinations consist of knowledge examinations after the end of the semester (Test). Test consists of theoretical questions and calculation problems. Students should have a positive result after each assessment with at least 50% of the required knowledge. Student must achieve a minimum of 54 cumulative points in order to pass the course. Students who intend to access the exam should be registered by the teaching assistant at latest two days before the exam. Registration includes A4 notebook on which it is necessary to write the name of the student, department, index number and academic year.

**20. Assessment components:**

Students obligations:	Weight (%)
Seminar work	60
Test -Final exam	40

**21. Required reading list:**

1. Klemeš, J., Smith, R. & Kim, J. K. (2008). Handbook of water and energy management in food processing. Cambridge: Woodhead Publishing.
2. Mann, J. G., Liu, Y. A. (1999). Industrial water reuse and wastewater minimization. New York: McGraw-Hill.

**22. Web sources:****23. Applicable starting from the academic year:**

2015/2016

**24. Adopted in the Faculty/Academy session:**