1. GENERAL INFORMATION

<table>
<thead>
<tr>
<th>1.1 Course teacher</th>
<th>Prof. Tomislav Bolanča, PhD</th>
<th>1.6 Year of the study</th>
<th>2 (3rd semester)</th>
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</thead>
<tbody>
<tr>
<td>Assoc. Prof. Šime Ukić, PhD</td>
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<tr>
<td>1.2 Name of the course</td>
<td>Chemometrics</td>
<td>1.7 ECTS credits</td>
<td>5</td>
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<td>1.3 Associate teachers</td>
<td>Matija Cvetnić, PhD</td>
<td>1.8 Type of instruction (number of hours L + E + S + e-learning)</td>
<td>Total: 60 (L 30, E 0, S 30)</td>
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<td>1.4 Study programme (undergraduate, graduate, integrated)</td>
<td>graduate</td>
<td>1.9 Expected enrolment in the course</td>
<td>10</td>
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<tr>
<td>1.5. Status of the course</td>
<td>☐ mandatory</td>
<td>☒ elective</td>
<td>1.10 Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)</td>
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2. COURSE DESCRIPTION

2.1. Course objectives
To introduce students to the importance of the use of mathematical and statistical methods to process real experimental data, to conduct multi-variant analysis and apply experimental design strategies. To insure their interaction with computer using standard software environment (MS Excel, MatLab, Statistica).

2.2. Enrolment requirements and/or entry competences required for the course
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2.3. Learning outcomes at the level of the programme to which the course contributes
- Solve engineering problems using the scientific method combining expert knowledge from chemistry, environmental, and chemical engineering as well as material science and engineering.
- Plan and independently perform experiments in order to confirm a hypothesis to estimate economic and ecological efficiency of processes.
- Apply different analytical techniques, analytical and numerical methods, as well as software tools in creative problem solving of engineering challenges, proposing sustainable technological solutions.
- Optimise complete and sustainable technological processes using analysis and modelling aimed at waste minimization utilising the strategy of the closed cycle manufacturing.
- Apply tools, methods and standards for monitoring and assessing the quality of processes and products, as well as their environmental impact, and to predict potential risks in working with technological processes and developing products.
- Create a critical analysis, evaluation and interpretation of personal results, and compare them with existing data in scientific and expert literature
- Demonstrate independence and reliability in independent work, as well as effectiveness, reliability and adaptability in team work
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)

1. To define data distributions.
2. To apply statistical hypothesis tests in chemistry.
3. To use methods of exploration of data in real chemical systems.
4. To apply methods of modelling and optimization
5. To extract useful information.
6. To calibrate analytical system, to process measured signal in order to obtain useful information.

2.5. Course content (syllabus)

Lectures:

**WEEK 1.** Introduction to chemometrics. Types of experimental data. The relationship between experimental data, information and knowledge.

**WEEK 2.** Basic Statistics in chemometrics. Probability. The distribution of the data. Types and sources of errors.


**WEEK 5.** Experimental design. Random blocks. Latin squares.

**WEEK 6.** Factor design. The use of blocking. Multi-factor analysis of variance.


**WEEK 8.** Partial exam


**WEEK 12.** Hierarchical cluster analysis. Distance and similarity. Single, full and centroid connection. Dendrograms.


**WEEK 15.** Partial exam.

2.6. Format of instruction:

- lectures
- seminars and workshops
- exercises
- online in entirety
- partial e-learning
- field work
- independent assignments
- multimedia and the internet
- laboratory
- work with mentor (other)

2.7. Comments:

2.8. Student responsibilities

Students are obligated to attend a minimum of 70% of all lectures and seminars
### 2.9. Monitoring student work

<table>
<thead>
<tr>
<th>Activity</th>
<th>YES</th>
<th>NO</th>
<th>(other)</th>
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</thead>
<tbody>
<tr>
<td>Class attendance</td>
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<td>Experimental work</td>
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<tr>
<td>Essay</td>
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<td>Preliminary exam</td>
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<td>Project</td>
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<td>Research</td>
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<td>Seminar paper</td>
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<td>Practical work</td>
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<tr>
<td>Written exam</td>
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| ECTS credits (total)   | 5   |    |         |

### 2.10. Required literature (available in the library and/or via other media)

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<tr>
<th>Title</th>
<th>Number of copies in the library</th>
<th>Availability via other media</th>
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### 2.11. Optional literature


### 2.12. Other (as the proposer wishes to add)