## 1. GENERAL INFORMATION

<table>
<thead>
<tr>
<th>1.1 Course teacher</th>
<th>Assist. Prof. Igor Dejanović, PhD</th>
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<tbody>
<tr>
<td>1.6 Year of the study</td>
<td>1st (1st semester)</td>
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<tr>
<td>1.2 Name of the course</td>
<td>Process Design and Economics</td>
</tr>
<tr>
<td>1.7 ECTS credits</td>
<td>5</td>
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<tr>
<td>1.3 Associate teachers</td>
<td>Goran Lukač, mag. ing. cheming.</td>
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<tr>
<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>
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<td>1.9 Expected enrolment in the course</td>
<td>20</td>
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<tr>
<td>1.5 Status of the course</td>
<td>☒ mandatory ☐ elective</td>
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<tr>
<td>1.10 Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)</td>
<td>2</td>
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## 2. COURSE DESCRIPTION

### 2.1. Course objectives
To master basic steps of chemical process design using knowledge acquired during undergraduate study. To acquire knowledge needed to perform basic economic analysis of a project.

### 2.2. Enrolment requirements and/or entry competences required for the course

### 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.
- 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.
- Demonstrate independence and reliability in independent work, as well as effectiveness, reliability and adaptability in teamwork.
- Outline results of independent and teamwork in a written and oral form to non-experts and experts in a clear and coherent way.

### 2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)

1. Synthesise process diagram for a specified task and model it using process simulators.
2. To create documentation comprising basic engineering design for a specified design task.
4. Synthesise basic mass exchange network
5. Estimate capital and operating expenses of a process.
6. Devise cash flow diagram and use it to calculate profitability criteria of a project.
2.5. Course content (syllabus)

**WEEK 1.** Introduction. Project documentation. Standards, codes and recommendations. Organization of a chemical engineering project; requested accuracy and project security factors. Contents of a project assignment.


**WEEK 3.** Reaction systems selection and design. Separation systems selection and design.

**WEEK 4.** Distillation system design. Distillation sequence synthesis. Azeotropic distillation


**WEEK 6.** Determining process energy targets – graphical and algebraic method. Composite curves and cascade diagrams.

**WEEK 7.** Designing heat exchanger network to fulfil determined targets. Threshold problems. Multiple pinches. Data extraction. Integration of reactors, distillation columns, evaporators, dryers, cooling systems, steam and cogeneration systems into the background process.

**WEEK 8.** Partial exam


**WEEK 10.** Algebraic method for mass integration – interval and cascade diagram. Water reduction through superstructure optimization.


**WEEK 12.** Engineering economic analysis. Time value of money and cash flow diagrams

**WEEK 13.** Calculating performance indicators from cash flow diagram.

**WEEK 14.** Profitability analysis – discounted and non-discounted criteria. Accounting for uncertainties in profitability analysis.

**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

- Class attendance YES
- Research NO
- Oral exam NO
- Experimental work NO
- Report NO
- Seminar paper (other)

- Essay NO
- Practical work NO
- (other)

- Preliminary exam YES
- Written exam YES
- ECTS credits (total) 5

2.9. Monitoring student work

- Project YES
- Written exam YES

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

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<thead>
<tr>
<th>Title</th>
<th>Number of copies in the library</th>
<th>Availability via other media</th>
</tr>
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<tbody>
<tr>
<td>R. Smith, CHEMICAL PROCESS, Design and integration, John Wiley &amp; Sons, 2005.</td>
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<tr>
<td>(as the proposer wishes to add)</td>
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