

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

**Predmet:** Optimizacijske metode v inženirstvu  
**Course title:** Optimization Methods in Engineering

| Študijski program in stopnja<br>Study programme and level                              | Študijska smer<br>Study field | Letnik<br>Academic year | Semester<br>Semester |
|--|-------------------------------|-------------------------|----------------------|
| Sonaravne tehnologije in sistemi v strojništvu - 3. stopnja                            | /                             | 1./2.                   | zimski/letni         |
| Sustainable technologies and systems in mechanical engineering - 3 <sup>rd</sup> cycle | /                             | first/second            | winter/summer        |

**Vrsta predmeta / Course type**

**Univerzitetna koda predmeta / University course code:**

| Predavanja<br>Lectures | Seminar<br>Seminar | Vaje<br>Tutorial | Laboratorijske vaje<br>work | Druge oblike študija | Samost. delo<br>Individ. work | ECTS |
|------------------------|--------------------|------------------|-----------------------------|----------------------|-------------------------------|------|
| 10                     |                    | 30               | 10                          | /                    | 250                           | 10   |

**Nosilec predmeta / Lecturer:**

**Jeziki / Languages:**  
**Predavanja / Lectures:** angleški/english  
**Vaje / Tutorial:** angleški/english

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** **Prerequisites:**

- Vpis v doktorski študijski program.
- Dodatnih pogojev ni.

**Vsebina:**

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**Content (Syllabus outline):**

This course addresses the use of multi-objective optimization methods in engineering design. After a general introduction to the multi-objective optimization principles, the students will be exposed to design of experiment techniques, state-of-the-art optimization algorithms, assessment methods and the use of meta-models for optimization. Advanced aspects like multi-criteria decision making and robustness will also be considered. The use of a state-of-the-art optimization software tool will provide students with concrete hands-on experience. The course will be complemented with successful examples of real industrial applications.

Topics covered will include:

- General introduction: multi-objective optimization problems, Pareto front
- Design of Experiments
- Algorithms for multi-objective optimization: genetic algorithms, simulated annealing
- Response Surface Models and its use for optimization
- Assessment methods
- Robustness
- Multi-criteria decision making
- Industrial applications, practical considerations, implications.

**Temeljni literatura in viri / Readings:**

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| <ol style="list-style-type: none"><li>1. Goldberg, D. E. <i>Genetic Algorithms in Search, Optimization, and Machine Learning</i>.</li><li>2. Rao, S. S. (1996) <i>Engineering Optimization: Theory and Practice</i>, John Wiley &amp; Sons.</li><li>3. Cavazzuti, M. (2012) <i>Optimization Methods: From Theory to Design Scientific and Technological Aspects in Mechanics</i>, Springer Science &amp; Business Media.</li></ol> |
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**Cilji in kompetence:**

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**Objectives and competences:**

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| <p>This course will provide the students with the ability to apply multi-objective optimization techniques in engineering design problems. Upon completion of the course, the students will:</p> <p>[1] understand the principles of multi-objective optimization,</p> <p>[2] be able to select the most appropriate optimization method to apply depending on the problem,</p> <p>[3] get a good knowledge of current applications of optimization techniques in industry and</p> <p>[4] have a practical experience with a state-of-the-art software tool for multi-objective optimization.</p> |
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**Predvideni študijski rezultati:**

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| <p>Znanje in razumevanje:<br/><i>Študent/študentka:</i></p> |
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**Intended learning outcomes:**

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| <p>Knowledge and understanding:</p> <ul style="list-style-type: none"><li>• understand the concepts, phenomena and processes,</li><li>• to find and use appropriate scientific literature,</li><li>• ability to apply theoretical knowledge in practice,</li><li>• to find the interconnection in simple and complex technological processes,</li><li>• be able critically evaluate the weak points in the process,</li><li>• to understand links to related learning courses.</li></ul> |
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**Metode poučevanja in učenja:****Learning and teaching methods:**

- *predavanja,*
- *računske in laboratorijske vaje s praktičnimi primeri iz industrije.*

- *lectures,*
- *computational and laboratory exercises with practical examples from the industry.*

Delež (v %) /

**Načini ocenjevanja:**

Weight (in %)

**Assessment:**

|                   |     |                  |
|-------------------|-----|------------------|
| Seminarska naloga | 40% | Project work     |
| Ustni izpit       | 60% | Oral examination |