## Syllabus

### Course description

<table>
<thead>
<tr>
<th>Course title</th>
<th>Design with Composite Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course code</td>
<td>47564</td>
</tr>
<tr>
<td><strong>Scientific sector</strong></td>
<td><strong>ING-IND/21</strong></td>
</tr>
<tr>
<td><strong>Degree</strong></td>
<td>Master in Industrial Mechanical Engineering</td>
</tr>
<tr>
<td><strong>Semester</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Year</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Academic year</strong></td>
<td>2024/2025</td>
</tr>
<tr>
<td><strong>Credits</strong></td>
<td>5</td>
</tr>
<tr>
<td><strong>Modular</strong></td>
<td>No</td>
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</table>

| **Total lecturing hours** | 28 |
| **Total lab and exercise hours** | 18 |
| **Attendance**            | Not mandatory but strongly recommended |

**Recommended preliminary knowledge**: basic material science, construction and production technologies, experimental physics

**Connections with other courses**: Design and manufacturing of industrial products, Advanced Topics on Machine Design, Finite Element Analysis

**Course page**: [https://www.unibz.it/en/faculties/engineering/master-industrial-mechanical-engineering/course-offering/?academicYear=2024](https://www.unibz.it/en/faculties/engineering/master-industrial-mechanical-engineering/course-offering/?academicYear=2024)

**Specific educational objectives**: Achieving an understanding of composite materials as an important technical means beyond structural applications; to be able to select material combinations based on the external load acting on the object; to get acquainted with different approaches to composite material design with an additional perspective on nature and biological inspired approaches; to gain knowledge on how to characterize composite materials and to assess their failure in operation to derive design optimizations.

### Lecturers

- Dr.-Ing. Leibenguth Peter  
  peter.leibenguth@unibz.it

- **Scientific sector of the lecturers**: ING-IND/14

- **Teaching language**: English

- **Office hours**: 15

- **Teaching assistant (if any)**: none

- **Office hours**: Upon appointment to be agreed via email, preferably after course times
| List of topics covered | 1. General introduction to composites and their history  
2. Materials in composite technology  
3. Technical applications going beyond the structural use  
4. Production and processing technologies  
5. Interfaces and surfaces  
6. Behaviour of composites: lab v. operational conditions  
7. Design and construction  
   a. Classical toolsets  
   b. Biomimetics and nature-inspired approaches  
   c. Optimization technologies  
   d. Material selection strategies  
8. Joining technologies  
9. Destructive and non-destructive characterization  
10. Failure assessments and their impact on design  
11. Recycling and sustainability considerations |
| Professional applications of the covered topics | Widespread application in automotive, aerospace, medical and sporting good products and technologies |
| Teaching format | Lecture and exercise |

| Learning outcomes (ILO) | 1. **Knowledge and understanding:**  
Students should know the theoretical background of diverse composite materials from materials, processing, calculation, and design perspective  

2. **Applying Knowledge and understanding:**  
Students should be able to discern the different properties and production methods of the basic material classes from those of composite materials. They should be able to select and use basic calculation methods to determine composite behaviour from data of the constituent materials.  

3. **Making judgments:**  
Students should be able to critically decide when to employ composite materials in component/product design, how to experimentally assess their properties and how to use failure cases analyses as a means to improve designs.  

4. **Communication skills:**  
Students should be able to present results of the exercises and contributions to discussions/own talks in appropriate technical/scientific language.  

5. **Learning skills**  
Students should be able to autonomously search and critically appraise technically relevant data, publications and case studies. |
### Assessment

<table>
<thead>
<tr>
<th>Form</th>
<th>Length /duration</th>
<th>ILOs assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-class exercises</td>
<td>9 x 120 min</td>
<td>1, 2, 3, 4, 5</td>
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### Summative assessment

<table>
<thead>
<tr>
<th>Form</th>
<th>%</th>
<th>Length /duration</th>
<th>ILOs assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam</td>
<td>100 %</td>
<td>2 hours</td>
<td>1, 2, 3, 4</td>
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### Assessment language

English

### Evaluation criteria and criteria for awarding marks

Performance in written exam

### Required readings


### Supplementary readings