CIVIL-443  
Advanced composites in engineering structures

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Cursus

<table>
<thead>
<tr>
<th>Civil &amp; Environmental Engineering</th>
<th>Sem.</th>
<th>Type</th>
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<tbody>
<tr>
<td>Civil Engineering</td>
<td>MA1, MA3</td>
<td>Opt.</td>
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<td>Mechanical engineering</td>
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<tr>
<th>Language of teaching</th>
<th>English</th>
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<tbody>
<tr>
<td>Credits</td>
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<tr>
<td>Session</td>
<td>Winter</td>
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<td>Semester</td>
<td>Fall</td>
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<tr>
<td>Exam</td>
<td>Oral</td>
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<tr>
<td>Workload</td>
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<tr>
<td>Weeks</td>
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<td>Hours</td>
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<tr>
<td>Lecture</td>
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<td>Exercises</td>
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<td>Number of positions</td>
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Summary

1. Introduce topics in properties, processing, mechanical behavior, characterization, analysis and structural design of Fiber Reinforced Composites
2. Help students develop their research skills through independent investigations on research topics

Content

1. Introduction-Basic ideas about composite materials, fibers, resins, applications
2. Manufacturing of composite materials-composite components
3. Basic mechanics of composites-Anisotropic theory of elasticity
4. Mechanics of laminates
5. Project report/Group meeting with teacher
6. Classical lamination theory
7. Failure of composite materials
8. Laboratory experience: Fabrication of composite laminates
9. Durability and long-term performance of composites
10. Laboratory experience: Experimental investigation of the behavior of composites
11. Project report/Group meeting with teacher #2
12. Strengthening of existing structures with composites
13. Fatigue of composites
14. Project hand out

Keywords

Composites, structures, design, analysis, matrix, fiber, project based

Learning Prerequisites

Required courses

Basic knowledge of physics, mechanics of materials, mathematics

Recommended courses

Basic knowledge of physics, mechanics of materials, mathematics

Learning Outcomes

By the end of the course, the student must be able to:

• Produce project ideas and a schedule to achieve the objectives
• Choose a relevant to their interests project
• Manage the schedule and the working group
• Synthesize the work and the group capabilities

Transversal skills
• Assess progress against the plan, and adapt the plan as appropriate.
• Plan and carry out activities in a way which makes optimal use of available time and other resources.
• Communicate effectively, being understood, including across different languages and cultures.
• Give feedback (critique) in an appropriate fashion.
• Take responsibility for environmental impacts of her/ his actions and decisions.
• Take feedback (critique) and respond in an appropriate manner.
• Manage priorities.
• Make an oral presentation.

Teaching methods
The material is presented by lectures and visits to the laboratory. Student evaluation is based on class participation and presentation of a project.

Expected student activities
Students are expected to participate, create groups and develop a group project. They need to work during the semester, show and discuss the group progress with the teacher to follow up the work plan.
Finally they must derive a project report and a presentation for the exam

Assessment methods
Project report delivered at the end of the semester, project presentation, class participation.

Supervision
Office hours No
Assistants No
Forum Yes

Resources
Virtual desktop infrastructure (VDI) No

Bibliography
Plenty of books on composites and composites’ design available at the EPFL library

Notes/Handbook
No textbook required. Lecture notes are distributed.

Moodle Link
• https://go.epfl.ch/CIVIL-443