

CIVIL-464

**Composites design and innovation**

| <b>Cursus</b>     | <b>Sem.</b> | <b>Type</b> |
|-------------------|-------------|-------------|
| Civil Engineering | MA2, MA4    | Opt.        |

|                            |                 |
|----------------------------|-----------------|
| Language of teaching       | English         |
| Credits                    | 3               |
| Session                    | Summer          |
| Semester                   | Spring          |
| Exam                       | Oral            |
| Workload                   | 90h             |
| Weeks                      | 14              |
| <b>Hours</b>               | <b>3 weekly</b> |
| Courses                    | 2 weekly        |
| Exercises                  | 1 weekly        |
| <b>Number of positions</b> |                 |

**Remark**

pas donné en 2020-21

**Summary**

The course offers the opportunity to gain practical experience in the characterization of fiber reinforced polymer and manufacturing/production methods for composite structures. The material is presented by lectures and visits to the laboratory. This is mainly a project based - hands on course

**Content**

The course Civil-464 "Composites design and innovation" offers to the students the possibility to work in a team and conceive, design, simulate, manufacture, test and validate a physical prototype of a composite structure/structural components.

Students will learn how to move from the conceptual design to the selection of raw materials and the fabrication of a composite structure prototype following all steps of modeling, simulation, manufacturing, and assessment. All steps of a product development cycle will be discovered in by each students group.

**Schedule:**

Week 1. Introduction to design with composites– Composite design practices

Week 2 Composite stress analysis – failure of composite structures

Week 3–Experimental investigation of composite materials

Week 4 Laboratory #1 – Laminate fabrication specimen

Week 5 Composite design/ joints in FRP structures

Week 6 Individual group work – conceptual design/preparation for fabrication

Week 7 Laboratory #2 – Specimen mechanical testing – property derivation – first report on mechanical performance

Week 8 Numerical simulation of composite structural performance #1

Week 9 Numerical simulation of composite structural performance #2

Week 10 Mid-term progress meeting

Week 11 Laboratory #3 – fabrication

Week 12 Laboratory #4 – fabrication

Week 13 Laboratory #5 – fabrication/assessment

Week 14 Laboratory #6 - Assessment

**Keywords**

Composites, Design, Product development, Life cycle analysis

**Learning Prerequisites****Recommended courses**

Basic knowledge of physics, mechanics of materials, mathematics

Previous participation to Civil-443 - Advanced composites in engineering structures would be an asset.

### Learning Outcomes

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

- Design and manufacture physical prototypes
- Coordinate a small multidisciplinary group
- Defend their project in front of an audience
- Analyze multiple parameters and take decisions
- Demonstrate the applicability of their product

### Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Set objectives and design an action plan to reach those objectives.
- Use a work methodology appropriate to the task.

### Expected student activities

Students are expected to attend the lectures and work on their project (in groups). The students would spend most of their time for the design (in their own place) and in the laboratory for the fabrication of their selected composite structure/structural component assisted in all steps of this process by the teaching team.

Laboratory work will be mainly executed in the facilities of the Structures and Materials laboratory of the Institute of Civil Engineering (IIC) <https://www.epfl.ch/schools/enac/research/research-iic/structures-and-materials/>, that will provide all necessary equipment and facilities for the experimental investigations and the manufacturing of the composite structures. The course will be affiliated to SKIL and students will be, as well as, able to work within SKIL for their projects and get support from SKIL personnel.

### Assessment methods

The evaluation of the course will be based on:

- Active participation
- Intermediate report
- Final project and report / assessment of the structure

Marks will be awarded based on the construction and aesthetics as well as the structural performance of the final product.

### Supervision

|              |     |
|--------------|-----|
| Office hours | No  |
| Assistants   | Yes |
| Forum        | Yes |

### Resources

#### Virtual desktop infrastructure (VDI)

Yes

#### Moodle Link

- <http://to be announced>

**Prerequisite for**

**"Le contenu de cette fiche de cours est susceptible d'être modifié en raison du covid-19"**