

CIVIL-464

Composites design and innovation

Cursus	Sem.	Type
Civil & Environmental Engineering		Opt.
Civil Engineering	MA2, MA4	Opt.
Civil engineering minor	E	Opt.

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

Remark

Pas donné en 2024-25

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 Simulation of composite structural performance #1
 Week 9 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.

Teaching methods

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

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)

No

Bibliography

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

Notes/Handbook

- **Experimental facilities** : The class has access to the GIS experimental facilities as well as at SKIL and SPOT

Moodle Link

- <https://go.epfl.ch/CIVIL-464>