How To Make (almost) Any Experiment Using Digital Fabrication

Lecturer
Denis TERWAGNE (Coordinator)

Course mnemonic
PHYS-F517

ECTS credits
5 credits

Language(s) of instruction
French

Course period
First term

Campus
Other campus

Course content

The "How To Make (Almost) Any Experiment Using Digital Fabrication" course is based on project-based learning and is aimed at students interested in digital fabrication techniques and the development of collaborative science and technology projects in the interdisciplinary world of fablabs.

The course is inspired by the famous "How To Make (Almost) Anything" course taught at MIT (USA), as well as the worldwide intensive "Fab Academy" training program. What's special about this course is that it focuses on the realization of experimental scientific and technical projects, with a strong emphasis on project management and group dynamics.

This is an immersive course immersed in the interdisciplinary environment of the ULB FabLab.

In the first part, students will learn various fablab techniques and create a digital portfolio demonstrating the acquisition of their technical skills. In particular, students will learn to :

- design 2D and 3D images using CAD (Computer Aided Design) software,
- print objects using a 3D printer,
- cut various materials using laser cutters, vinyl cutters or digital milling machines,
- assemble and integrate the above techniques to develop an experimental device,
- use electronic sensors and micro-controllers, such as Arduino or Raspberry Pi, for experimental data acquisition,
- learn how to post-process and interpret the acquired data,
- use graphical user interfaces and software for data presentation,
- use the GIT system for real-time, open and shared documentation.

In the second part, with the help of mentors, students will learn to work in interdisciplinary groups to identify societal problems and develop a solution, putting their social, scientific and technical skills at the service of the group.

Objectives (and/or specific learning outcomes)

This course, designed for a scientific audience, aims to open students up to new technologies, digital fabrication and the great potential of the Fablab network to enhance their experimental skills and respond to societal challenges. It will enable students to develop their technological, communication, collaboration and project management skills in an interdisciplinary environment. These four skills are essential in today's modern world.

Teaching method and learning activities

This course will be taught at the ULB FabLab in USquare. Students will learn rapid prototyping techniques by preparing and executing a new exercise (involving the discovery of a new technique) each week. Finally, students will put the knowledge and skills they have learned into practice by developing a final experimental research project in interdisciplinary groups in a FabLab environment.

Week after week, students will document their work to create a portfolio of their technical achievements, and share their experiences with their peers.

See the student portfolios for the following editions

- 2022-2023: https://fablab-ulb.gitlab.io/enseignements/2022-2023/fabzero-experiments/class-website/
- 2021-2022: https://fablab-ulb.gitlab.io/enseignements/2021-2022/fabzero-experiments/class-website/
- 2020-2021: https://fablab-ulb.gitlab.io/enseignements/2020-2021/fabzero-experiments/class-website/

The course includes a number of pedagogical devices arranged according to a timetable that will be specified during the first course sessions.

Contribution to the teaching profile

This course offers a practical introduction to the digital tools available in a Fablab environment, enabling the design and manufacture of (almost) any scientific and technical experimental device.

The course also provides experience of working in an interdisciplinary environment with students from different disciplines (physical sciences, chemistry, biology, computer science, bioengineering, civil engineering, etc.) and different levels (bachelor's and master's degrees), using project management and collective intelligence techniques.

References, bibliography and recommended reading

- Fab Academy - https://fabacademy.org/

- N. Gershenfeld, A. Gershenfeld and J. Cutcher-Gershenfeld, Designing Reality (Basic Books, New- York, 2017).
- J. M. Pearce Open-Source Lab: How to Build Your Own Hardware and Reduce Scientific Research Costs (Elsevier, 2014).

Other information

Place(s) of teaching

Other campus

Contact(s)

Denis Terwagne (Denis.Terwagne@ulb.be)

Evaluation method(s)

Other

Evaluation method(s) (additional information)

The weekly exercises carried out by students and the final project (documented and presented before a jury) will be assessed.

Attendance at both theory and practical classes is compulsory and a prerequisite for successful completion of the course; assessment is continuous and culminates in a final presentation. No exams. No second session.

Attendance at the first class is essential. In the event of absence due to force majeure, please contact Mr Terwagne as soon as possible.

Main language(s) of evaluation

English and French

Programmes

Programmes proposing this course at the faculty of Sciences

BA-BIOL | Bachelor in Biology | option Bruxelles/unit 2 and option Bruxelles/unit 3, BA-CHIM | Bachelor in Chemistry | unit 2, BA-INFO | Bachelor in Computer science | unit 3, BA-IRBI | Bachelor in Bioengineering | unit 3, BA-MATH | Bachelor in Mathematics | unit 3 and MA-PHYS | Master in Physics | finalité Research/unit 1 and finalité Teaching/unit 1

Programmes proposing this course at the Brussels School of Engineering

BA-IRBI | Bachelor in Bioengineering | unit 3, MA-IRAR | Master of science in Architecture and Engineering | finalité Professional/unit 2, MA-IRCB | Master of science in Biomedical Engineering | finalité Professional/unit 2, MA-IRCN | Master of science in Civil Engineering | finalité Professional/unit 2, MA-IREL | Master of science in Electrical Engineering | finalité electronics and information technologies/unit 2, MA-IREM | Master of science in Electromechanical Engineering | finalité Professional/unit 2 and finalité Operations engineering and management/unit 2, MA-IRIF | Master of science in Computer Science and Engineering | finalité Professional/unit 2, MA-IRMA | Master of Science in Chemical and Materials Engineering | finalité Professional/unit 2 and MA-IRPH | Master of science in Physical Engineering | finalité Professional/unit 2