

<b>Course edition</b>	<b>2</b>	<b>Academic Year</b>	<b>2023/2024</b>
<b>Ref.</b>	<b>MBUILD05/ M15</b>		
<b>MODULE</b>	<b>PI1/IP1 – INTEGRATED PROJECT 1</b>		
ECTS	6		
Year/Semester	Y1/S1		
Class hours	4 h/week * 13 weeks = 52 h		
Teaching location	FEUP, Porto, Portugal		

## 1. OBJECTIVES

The three Integrated Project 1/2/3 modules aim at proposing challenges to the students and let them explore it, as they see fit, under the guidance and suggestions of their teachers. These modules exist in the three semesters and, in each university, the focus will be, sequentially (i) The Building (FEUP), (ii) The City (THM) and (iii) The Infrastructures (UC), obviously with some overlapping and complementarity of viewpoints, as well as providing other type of tools/reflections/resources.

The results of the work developed in IP1 will be transmitted to the other partner universities, which may use it to the degree they feel more adequate. Therefore, there may be situations where the challenge proposed in FEUP/UP will be act as a base to be further developed in THM and UC, while in other years the students will face different challenges in IP2/3; it will depend on the outcome.

This to say that IP1, in particular – focused in The Building – will present a challenge in which the students will have to gather framing information and, then, develop their own proposal to tackle the challenge that was put forward.

As a module where group work is essential, taking into account the diversity of background and expertise, the results may – and should – address different perspectives, developing more deeply certain aspects in which the team members are more knowledgeable or motivated, while other teams may decide to follow different approaches. At the end, all work will be shared by the class, fostering the exchange of reasonings, understanding specific concerns and how to cope with them.

For short, each group will find its own way and present what they feel is relevant for the challenge, developing the design information that it is capable of making the most of their individual expertise.

## 2. LEARNING OUTCOMES AND COMPETENCES

- Understanding and developing the framework of a challenge put forward by a client;
- Developing a State of the Art of the issues at hand;
- Organising the output of the SoA and defining the requirements to be addressed in the proposal;
- Establishing the work division within the group and planning the stages+deliverables required;
- Planning and defining the way the proposal should be presented;
- Present the proposal in a professional way, supported by client-oriented supporting documents.

### 3. SYLLABUS/TOPICS

Housing buildings have the largest percentage of all constructed buildings in most – if not all – countries. Housing is a basic need, and the Construction Industry should be aware of the social importance it has in this respect.

At the same time, CI is one of the industries with the largest – arguably the largest - impact in the planet under the perspective of sustainability and environment effects. CI uses an enormous amount of raw materials, transforms them through processes requiring a high energy input and provoking enormous pollution, delivers products that are, usually, very rigid and difficult to reuse, refurbish, dispose of.

In the last years, in some way fueled by an international economic context that has seen prices and rents of housing to rise to unprecedented levels, some different approaches to the challenge of “building a house” have emerged. Some of them have already been around for some time – as prefabrication – but, in essence, two of the main problems of the traditional construction methods have not changed: (i) building a house by traditional methods takes a lot of time and (ii) when wishing to change, refurbish or demolish a housing building, usually the hammer or the bulldozer are the tools of choice, leaving very little to reuse and requiring new supplies, that used more raw materials, energy and so on.

Starting from this description, the challenge for this year’s IP1 will be:

**DEVELOP A BASE DESIGN FOR AN INDUSTRIALIZED MODULE THAT MAY BE USED FOR INDIVIDUAL AND COLLECTIVE HOUSING SCHEMES, RELYING MOSTLY ON DRY CONSTRUCTION METHODS.**

The main aspects that the responses to this challenge will need to address, are:

- **Industrialized solution**, i.e., capable of being constructed offsite and transported to the building site;
- **Modular solution**, i.e., capable of being associated and provide spaces of different sizes, and for the different purposes that a home will have to answer to;
- **Individual and collective schemes**, i.e., capable of being used as a stand-alone individual house or integrated in a housing building;
- **Dry construction**, i.e., using, as much as possible, materials and connection processes that will enable its creation as an industrialized product, and its future disassembly with the largest possible recovering and reuse of materials.

To allow a more focused idealization of the challenge, let us use as inspiration a Danish building that includes both functional requirements mentioned above. It is the Nybrogård Kollegiet, in Lyngby (just North of Copenhagen):

<https://earth.google.com/web/@55.77270873,12.47622707,25.53880598a,937.4348794d,35y,0.00035898h,0t,0r>



This complex is a students’ residence which joins two types of housing solutions: (i) in the longer and wider buildings, individual rooms (room/living room + bathroom) with collective kitchens at the top of each floor; and (ii) in the shorter connecting buildings, small apartments (1/2 rooms+living room + kitchen+bathroom).

We will discuss this further in class but, the general outline of your work will be:

1. Research about modular construction for buildings;
2. Research about DfMA Design for Manufacture and Assembly and Offsite construction;
3. Research for housing evolution;
4. Research about non-adesive and non-water based construction systems and building components;
5. General research about the EU regulation frameworks pertinent to housing construction (areas, energy and acoustic efficiency, structural behaviour, durability, maintenance, etc.);
6. Develop and present a SoA about 1-5;
7. Define the set of requirements that will be – ideally – fulfilled in the proposal;
8. Decide about the strategy that is going to be followed for the base design;
9. Decide about the expertises that will be developed more deeply and the ones that will be kept as a concept or even omitted;
10. Define and develop the architectural concept of the proposal and its possible arrangements;
11. Define and develop the concept for the structure of the proposal;
12. Define and develop the concept for the non-structural elements' of the proposal;
13. Define and develop the concept for the water areas of the proposal;
14. Define and specify the construction methods for the application of finishes, interior and exterior frameworks and its efficiency regarding thermal/acoustic behaviour and watertightness;
15. Decide and develop the final presentation of the proposal;
16. Presentation and discussion of the proposal.

These items should be considered as general guideline of the work to be developed. Time is limited, so the result is not expected to be a complete design for all expertise, but to present viable solutions that, with time, could be further developed until a detailed design for production may be achieved

Also, and this is important, being a challenge, different approaches will be possible, each excelling in some aspects and less in others; that should not be a problem and the class will benefit from the exchange of knowledge arising from those varied ideas, ways of working and decisions.

**Every week, preferably in the second class, each group will present the development of its findings during the previous week.** This presentation will be informal, surely with work still under development; this is to say that the slides do not need to be too polished but, essentially, a way to present the stage of development of the work, the questions you need to be answered or direction from the teachers or, even, receive suggestions for your fellow colleagues. On the other hand, these slides will become a good base for the formal presentations to be done.

#### 4. MANDATORY REFERENCES

To be provided during the classes, according to the development of the themes and the work developed by the students.

#### 5. ADDITIONAL REFERENCES

- Housing in Europe 2021 <https://ec.europa.eu/eurostat/cache/digpub/housing/index.html?lang=en>
- Europe Housing Forum <https://europehousingforum.eu/>
- Building Regulations in Europe Pt2  
[https://www.researchgate.net/publication/27345366\\_Building\\_regulations\\_in\\_Europe\\_Part\\_II\\_A\\_comparison\\_of\\_technical\\_requirements\\_in\\_eight\\_European\\_countries](https://www.researchgate.net/publication/27345366_Building_regulations_in_Europe_Part_II_A_comparison_of_technical_requirements_in_eight_European_countries)
- Manual of Standard Building Specifications [https://ec.europa.eu/info/sites/default/files/mit-1-performance-and-technical-performance-specification\\_en.pdf](https://ec.europa.eu/info/sites/default/files/mit-1-performance-and-technical-performance-specification_en.pdf)

- RIBA Plan of Work 2020 – DfMA Designing for Manufacture and Assembly Overlay  
<https://www.architecture.com/knowledge-and-resources/resources-landing-page/dfma-overlay-to-the-riba-plan-of-work>
- Modular construction: From projects to products – McKinsey  
<https://www.mckinsey.com/capabilities/operations/our-insights/modular-construction-from-projects-to-products>
- Other resources to be provided during the module.

## 6. ASSESSMENT TYPE

---

- Distributed only (courseworks and activities developed during the semester)

## 7. ASSESSMENT COMPONENTS AND CALCULATION OF FINAL GRADE

---

### 7.1. Normal assessment

The module will be assessed by:

- Coursework, to be developed during the teaching period;
- Presentation and discussion, at the end of the teaching period.

Group Coursework	75%
Presentation and discussion	25%
	100%

### 7.2. Resit assessment

In the case of students that failed the module in the normal assessment, and as the next instance of the module will occur when they will not be in FEUP, the following procedure will be followed:

- Individual upgrade of the Coursework;
- Individual discussion, to be done online;

## 8. TEACHING STAFF

---

Name	Position	University	email
Jorge Moreira da Costa JMC	Associate Professor	FEUP/UP	<a href="mailto:jmfcosta@fe.up.pt">jmfcosta@fe.up.pt</a>
Bárbara Rangel BR	Assistant Professor	FEUP/UP	<a href="mailto:rangel@gcloud.fe.up.pt">rangel@gcloud.fe.up.pt</a>