

# Course guide 310425 - 310425 - Wood Construction in the 21st Century

Last modified: 15/05/2023

Unit in charge: Teaching unit:	Barcelona School of Building Construction 753 - TA - Department of Architectural Technology.		
Degree:	MASTER'S DEGREE IN ADV	ANCED BUILDING CONSTRUCTION (Syllabus 2014). (Optional subject).	
Academic year: 2023	ECTS Credits: 5.0	Languages: Catalan, Spanish, English	

# **LECTURER**

Coordinating lecturer:	EDGAR SEGUÉS AGUASCA
Others:	Haurie Ibarra, Laia
	Blasco Miguel, Jorge
	Giraldo Forero, Maria Del Pilar
	Hormias Laperal, Emilio

# **DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES**

#### Specific:

CE1. Capacity of innovation: identify the reasons and the mechanisms of the technologic and technical changes.

CE9. Make a model of structures of buildings and evaluate the load they can support.

CE12. Define the characteristics of the sismic action and apply the present regulations to the sismic calculation of structures in building construction.

# Generical:

CG4. Develope and/or apply ideas with originality in a context of investigation, identifying and formulating hypothesis or innovative ideas and submit them to a objectivity, coherence, and viability test.

CG5. Analyse, evaluate and synthesise critically, new and difficult ideas of promotion, in academic and professional contexts, cientific advances, technologics, socials or culturals in the society of knowledge.

#### Transversal:

05 TEQ. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.

03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

# **Basic:**

CB6. Possess and understand knowledge which provide a basis or opportunity to be original in the development and/or application of ideas, usually in a context of research.

CB9. The students must be able to communicate their conclusions and the knowledges and ultimate reasons which support to specialised and non-specialised audiences in a clear mode and without ambiguities.

# **TEACHING METHODOLOGY**

The course will be based on theory classes, problem classes, practices in the materials laboratory and in the fire laboratory, and basic calculation exercises for structures and individual and team work.



# LEARNING OBJECTIVES OF THE SUBJECT

In this subject individual and group work will be promoted.

The face-to-face classes will be distributed as follows:

- Theoretical classes in which the teacher will present the contents of the subject and present practical cases to motivate the students.

- Laboratory practices.

-Exercises for calculating wooden structures.

-Guided activities (mainly conferences and technical visits to wooden buildings under construction or already finished, Pasive House, etc.)

# **STUDY LOAD**

Туре	Hours	Percentage
Guided activities	10,0	8.00
Hours large group	15,0	12.00
Self study	90,0	72.00
Hours medium group	5,0	4.00
Hours small group	5,0	4.00

# Total learning time: 125 h

# CONTENTS

# The wood in construction throughout history. China, Japan, Nordic Countries, Southern Europe, etc.

#### **Description:**

This section will study the evolution of wood construction techniques, unique buildings. Chinese and Japanese pagodas and temples, Nordic churches, wooden Roman bridges and other buildings that stood out for the evolution of their technology and knowledge of the material.

Full-or-part-time: 4h 30m Theory classes: 2h Self study : 2h 30m

# Wood as a construction material. Solid wood, structural sawn wood and processed wood products (Engineered wood)

#### **Description:**

Study of the characteristics and properties of wood. Brief introduction to solid wood as a construction material to make way for the evolution of transformed wood products for construction that have allowed wood to evolve into the products used today: Plywood, Laminated veneer lumber (LVL), laminated wood, Cross laminated timber (CLT), etc.

**Full-or-part-time:** 4h 30m Theory classes: 2h Self study : 2h 30m



#### Wood decay. Retrofit techniques and treatments in existing buildings.

#### **Description:**

In this part of the subject we will study the wood decay types. Then we will analyze retrofiting techniques and treatment methods to be applied in existing buildings.

### **Specific objectives:**

To Know the decay wood types. Get knowledges about retrofit and refurbishment techniques in eisting buildings. know treatments to apply in wood products to protect it.

**Related activities:** 

Lecture 3

**Full-or-part-time:** 3h Theory classes: 2h Self study : 1h

#### Introduction to the calculation of structures.

# **Description:**

In these classes the student will be introduced to the calculation of wooden structures and their peculiarities. Some structure calculation program will be used.

### **Related activities:**

In this section, theoretical classes will be held to learn or refresh the knowledge of calculating structures. Some computing application will be used.

Individual work and team work will be carried out.

# Full-or-part-time: 9h 50m

Theory classes: 2h Practical classes: 1h Guided activities: 1h Self study : 5h 50m

# State of the art of wood construction in the world in 2020

# **Description:**

Current state of wood construction in the world. Technically more advanced buildings due to their difficulty or dimensions in the world to this day.

The Mjøsa tower (Mjøstårnet) in Norway 85.4 meters high, Brock Commons Tower in Vancouver 53 meters, The treet in Bergen, Norway, 49 meters and in Spain The borda in Barcelona PB + 6 the highest wooden when it was built, or the promotion of 65 homes in Hondarribia, the largest timber development in southern Europe at the time of its construction, 2019.

**Full-or-part-time:** 7h 20m Theory classes: 3h Guided activities: 1h Self study : 3h 20m



#### **Connections and construction systems**

# **Description:**

We will study the different types of connections that exist in the field of wood construction, their operation and the models of calculation and structural analysis.

The different wood construction systems that exist in the world will also be studied.

#### Full-or-part-time: 3h

Theory classes: 2h Self study : 1h

# Construction typologies used in the most advanced wooden buildings in the world.

#### **Description:**

In this class, the constructive typologies that have allowed the construction of the buildings studied in the previous chapter will be studied.

Pannel Syetems Puukuokka Houssing Block, Jyväskylä, Finland Frame systems: Wood Innovation and Design Center, Prince George, Canada Hybrid Systems LCT ONE Voralberg, Dornbirn, Austria

**Full-or-part-time:** 6h 40m Theory classes: 2h

Guided activities: 1h Self study : 3h 40m

#### Wood and fire, advantages and limitations

#### **Description:**

In this section we will study the behavior of wood against fire. The predictability of its behavior, The limitations of typologies and heights due to its combustibility.

Knowledge of the behavior of tall buildings in the event of fires.

Treatments and protections that can be made to wood to make it safer in case of fire Related regulations.

#### **Related activities:**

Theoretical classes. Simulation exercise classes. Tests in the EPSEB fire laboratory

# Full-or-part-time: 12h

Theory classes: 2h Practical classes: 1h Laboratory classes: 2h Self study : 7h

#### Wooden buildings and their behavior against earthquakes

#### **Description:**

This section will study the behavior of wooden structures in the face of the earthquake. The advantages and disadvantages of wooden buildings and techniques to improve their behavior.

# Full-or-part-time: 9h

Theory classes: 2h Practical classes: 2h Self study : 5h



# ACTIVITIES

Laboratory practice to perform mechanical tests on various wooden elements

**Full-or-part-time:** 2h Laboratory classes: 2h

# Fire laboratory practices to understand the behavior of wood and ways to improve it in case of fire.

**Full-or-part-time:** 2h Laboratory classes: 2h

# **GRADING SYSTEM**

Team work 35%, exercices and laboratory 30%, exam 35%

# BIBLIOGRAPHY

#### **Basic:**

- Green, Michael; Taggart, Jim. Tall wood buildings : design, construction and performance . Basel : BirkhaÌ□user, 2017. ISBN 978-3-0356-0475-7.

- Peraza Sánchez, Fernando; Peraza Sánchez, José Enrique; Iñiguez, Guillermo; Montón Lecumberri, Joaquín; Luengo Cuadrado, Emilio; Bobadilla Maldonado, Ignacio. Guía de la madera. Madrid : AITIM, 2010-2014. ISBN 9788487381409.

- Kaufmann, Hermann; Krötsch, Stefan; Winter, Stefan. Manual of Multistorey Timber Construction . München : Edition Detail , [2018]. ISBN 978-3-95553-394-6.