# Course guide
# 310400 - 310400 - Engineering in 20th and 21st Century Architecture

**Last modified:** 06/06/2024

**Unit in charge:** Barcelona School of Building Construction
**Teaching unit:** 756 - THATC - Department of History and Theory of Architecture and Communication Techniques.

**Degree:** MASTER'S DEGREE IN ADVANCED BUILDING CONSTRUCTION (Syllabus 2014). (Compulsory subject).

**Academic year:** 2024 **ECTS Credits:** 5.0 **Languages:** Spanish

## LECTURER

**Coordinating lecturer:** Graus Rovira, Ramon

**Others:** Graus Rovira, Ramon
Navas Ferrer, Maria Teresa
Navarro Gonzalez, Ruben

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**
6. Capacity of innovation: identify the reasons and the mechanisms of the technologic and technical changes.
7. Make a model of structures of buildings and evaluate the load they can support.

**Generical:**
8. Prepare to communicate with efficiency, orally but also in written.
9. Prepare the student in the using of tools that are common in the investigation activities, like the analysis and treatment of data, just like methodology and investigation techiniques.

**Transversal:**
11. SUSTAINABILITY AND SOCIAL COMMITMENT. Being aware of and understanding the complexity of social and economic phenomena that characterize the welfare society. Having the ability to relate welfare to globalization and sustainability. Being able to make a balanced use of techniques, technology, the economy and sustainability.
12. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

**Basic:**
2. 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.
3. The students must be able to apply the acquired knowledges and their ability of resolution of problems in new or little known environments inside more wide environments (or multidisciplinary) related with their study field.
4. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsabilities linked to the application of their knowledges and opinions.
5. 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.
1. The students must possess the learning abilities which allow them to continue studying in a way which should be to a large extent self-directed and autonomous.

## TEACHING METHODOLOGY

Two supplementary approaches will be combined: the historical view and the biographical view. The historical approach shows the technological changes in the architecture, inside the cultural, social and economic milieu; while the biographical approach allows to see, in the framework of the technological innovations, the diversity (educational and occupational) of what means to be an engineer in the architecture of the contemporaneity.

Lectures will be done, combined with master classes to motivate and facilitate the learning and the deep reflection of the topics objective of the course. In the same way, inside the in-person schedule there will be reserved a space to guide the works and the autonomous practices.

## LEARNING OBJECTIVES OF THE SUBJECT

At the end of the subject, the students should be able to:
- Understand what means to be an engineer in the contemporaneity and its educational and occupational diversity.
- Define the own constructive features of each period of the architecture of the 20th and 21st centuries.
- To value the role of the technology in the architecture and the engineering of the 20th and 21st centuries and the influence of the architecture and the engineering in technological changes.
- Recognize the design strategies of each one of the engineers studied during the course.
- Determine the construction period of a building.
- Explain reasonably the meaning of the different technological innovations published during the 20th and 21st centuries.
- Use the existing tools and resources for the documentation of a building.

## STUDY LOAD

| Type | Hours | Percentage |
|---|---|---|
| Hours medium group | 5,0 | 4.00 |
| Guided activities | 7,5 | 6.00 |
| Hours large group | 17,5 | 14.00 |
| Hours small group | 5,0 | 4.00 |
| Self study | 90,0 | 72.00 |

**Total learning time:** 125 h

## CONTENTS

### C1 INTRODUCTION

**Description:**
In this content, there will be done two sessions:

1. The steel frame and the new conception of the binomial structure-enclosure.
2. The reinforced concrete, structural technique of the 20th century.

**Specific objectives:**
- Understand what means to be an engineer in the contemporaneity and its educational and occupational diversity.
- Define the own constructive features of each period of the architecture of the 20th and 21st centuries.
- To value the role of the technology in the architecture and the engineering of the 20th and 21st centuries and the influence of the architecture and the engineering in the technological changes.
- Recognize the design strategies of each one of the engineers studied during the course.
- Determine the construction period of a building.
- Explain reasonably the meaning of the different technological innovations published during the 20th and 21st centuries.
- Use the existing tools and resources for the documentation of a building.

**Related activities:**
A1 Weekly quiz

**Related competencies :**
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.

**Full-or-part-time:** 16h
Theory classes: 3h
Self study : 13h

## C2 THE ROLE OF TECHNOLOGY IN SHAPING THE ARCHITECTURE OF THE MODERN MOVEMENT

**Description:**
In this content there will be done 7 sessions:

3. Industrial architecture: From Behrens to Gropius.
4. Technology and architecture in the work of Auguste Perret.
5. Engineering and "place".
6. Technology and architecture in the work of Le Corbusier.
7. Taylorism and neues Bauen.
8. Technology and architecture in the work of Mies van der Rohe.
9. Architecture and engineering in Spain. Eduardo Torroja and Carlos Fernández-Casado

**Specific objectives:**
- Understand what means to be an engineer in the contemporaneity and its educational and occupational diversity.
- Define the constructive features of each period of the architecture of the 20th and 21st centuries.
- To value the role of the technique in the architecture and the engineering of the 20th and 21st centuries and the weight of the architecture and the engineering in the technological changes.
- Recognize the design strategies of each one of the engineers studied during the course.
- Determine the construction period of a building.
- Explain reasonably the meaning of the different technological innovations published during the 20th and 21st centuries.
- Use the existing tools and resources for the documentation of a building.

**Related activities:**
A1 Wekly quiz
A2 Cite and reference in ISO-690
A3 Reading and text commentary: inter-war period

**Related competencies :**
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.
CB10. The students must possess the learning abilities which allow them to continue studying in a way which should be to a large extent self-directed and autonomous.
CB8. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsabilities linked to the application of their knowledges and opinions.
CB7. The students must be able to apply the acquired knowledges and their ability of resolution of problems in new or little known environments inside more wide environments (or multidisciplinary) related with their study field.
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.
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.
CG2. Prepare to communicate with efficiency, orally but also in written.

**Full-or-part-time:** 50h
Theory classes: 11h 40m
Practical classes: 2h
Laboratory classes: 3h
Guided activities: 5h
Self study : 28h 20m

## C3 ENGINEERING IN POSTWAR ARCHITECTURE

**Description:**
In this content there will be done 7 sessions:

10. Exploring advanced techniques: Richard Buckminster Fuller, Case Study House Program, J.J. Polívka.
11. Craftsmans of the industry: Jean Prouvé, Miguel Fisac.
12. The glass box and the second transformation of the extrnal walls.
13. Technological debates about the collective housing during the European post-War period.
14. The visible construction: Louis I. Kahn with August Komendant, Stirling & Gowan with Frank Newby.
15. Origin and limits of the high-tech architecture.

**Specific objectives:**
- Understand what means to be an engineer in the contemporaneity and its educational and occupational diversity.
- Define the constructive features of each period of the architecture of the 20th and 21st centuries.
- To value the role of the technology in the architecture and the engineering of the 20th and 21st centuries and the influence of architecture and engineering in technological changes.
- Recognize the design strategies of each one of the engineers studied during the course.
- Determine the construction period of a building.
- Explain reasonably the meaning of the different technological innovations published during the 20th and 21st centuries.
- Use the existing tools and resources for the documentation of a building.

**Related activities:**
A1 Weekly quiz
A4 Reading and text commentary: Post-war period

**Related competencies :**
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.
CB10. The students must possess the learning abilities which allow them to continue studying in a way which should be to a large extent self-directed and autonomous.
CB8. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsabilities linked to the application of their knowledges and opinions.
CB7. The students must be able to apply the acquired knowledges and their ability of resolution of problems in new or little known environments inside more wide environments (or multidisciplinary) related with their study field.
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.
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.
CG2. Prepare to communicate with efficiency, orally but also in written.

**Full-or-part-time:** 65h 40m
Theory classes: 11h 40m
Practical classes: 3h
Laboratory classes: 2h
Guided activities: 4h
Self study : 45h

## ACTIVITIES

### A1 WEEKLY QUIZ

**Description:**
The student will be tested weekly (five questions on-line).

**Specific objectives:**
- Understand what means to be an engineer in the contemporaneity and its educational and occupational diversity.
- Define the own constructive features of each period of the architecture of the XX and XXI centuries.
- To value the role of the technique in the architecture and the engineering of the XX and XXI centuries and the weight of the architecture and the engineering in the technical changes.
- Recognize the design strategies of each one of the engineers studied during the course.
- Determine the construction period of a building.
- Explain reasonably the meaning of the different technical innovations published during the XX and XXI centuries.
- Use the existing tools and resources for the documentation of a building.

**Material:**
At the beginning of the course a list of the topics to study will be delivered to the students.

**Delivery:**
Atenea.

**Related competencies :**
CB10. The students must possess the learning abilities which allow them to continue studying in a way which should be to a large extent self-directed and autonomous.
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.
CB8. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsabilities linked to the application of their knowledges and opinions.
CB7. The students must be able to apply the acquired knowledges and their ability of resolution of problems in new or little known environments inside more wide environments (or multidisciplinary) related with their study field.
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.
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.
CG2. Prepare to communicate with efficiency, orally but also in written.

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

### A2 COLLECTIVE READING OF A BOOK

**Description:**
Each week, in class, led by a group of two or three students, previously warned, a critical reading of a book will be carried out. The key points of the text will be discussed and illustrated with the buildings that the text itself proposes. Each group will make a documented presentation of the text and the buildings and a debate will be opened within the class. The grade will compute 20% of the final grade.

**Specific objectives:**
- To value the role of the technique in the architecture and engineering of the XX and XXI centuries and the significance of the architecture and engineering in the technical changes.
- Explain reasonably the meaning of the different technical innovations published during the XX and XXI centuries.

**Material:**
PARICIO, Ignacio. Construcciones para iniciar un siglo. Barcelona, Bisagra, 2000.

**Delivery:**
Without submission.

**Full-or-part-time:** 7h
Theory classes: 7h

### A3 CITE AND REFERENCE IN ISO-690

**Description:**
Write a one page document. Cite and reference in ISO-690.

**Specific objectives:**
- To cite papers correctly.

**Material:**
https://www.mendeley.com

**Delivery:**
Atenea.

**Related competencies :**
CB8. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsabilities linked to the application of their knowledges and opinions.
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.

**Full-or-part-time:** 9h
Guided activities: 9h

**A4 READING AND TEXT COMMENTARY: INTERWAR PERIOD**

**Description:**
The student will choose an article of the list to read it and make a critical remark. The text will have an extension between 7,000 and 8,000 characters.

**Specific objectives:**
- To value the role of the technique in the architecture and engineering of the XX and XXI centuries and the significance of the architecture and engineering in the technical changes.
- Explain reasonably the meaning of the different technical innovations published during the XX and XXI centuries.

**Material:**
A list of articles on the topics to be studied will be given to the student at the beginning of the course.

**Delivery:**
Pre-delivery (supervised activity): Atenea.
Final delivery: Atenea.
The use of generative AI tools must be cited at all times.

**Related competencies :**
CB10. The students must possess the learning abilities which allow them to continue studying in a way which should be to a large extent self-directed and autonomous.
CB8. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsabilities linked to the application of their knowledges and opinions.
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.
CG2. Prepare to communicate with efficiency, orally but also in written.

**Full-or-part-time:** 3h 30m
Guided activities: 3h 30m

**A5 READING AND TEXT COMMENTARY: POST-WAR PERIOD**

**Description:**
The student will choose an article of the articles list to read it and make a critical remark. The text will have an extension between 7,000 and 8,000 characters.

**Specific objectives:**
- To value the role of the technique in the architecture and engineering of the XX and XXI centuries and the significance of the architecture and engineering in the technical changes.
- Explain reasonably the meaning of the different technical innovations published during the XX and XXI centuries.

**Material:**
At the beginning of the course there will be deliveried to the students a list of articles about the topics to study.

**Delivery:**
Final delivery: Atenea.
The use of generative AI tools must be cited at all times

**Related competencies :**
CB8. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsabilities linked to the application of their knowledges and opinions.
CB10. The students must possess the learning abilities which allow them to continue studying in a way which should be to a large extent self-directed and autonomous.
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.
CG2. Prepare to communicate with efficiency, orally but also in written.

**Full-or-part-time:** 4h
Guided activities: 4h

## GRADING SYSTEM

Task A1 - Weekly quiz: 20% of the final mark.
Task A2 - Collective reading: 20% of the final mark.
Task A3 - Cite and reference in ISO-690. 10% of the final mark.
Task A4 - Reading and text commentary: inter-war period: 20% of the final mark.
Task A5 - Reading and text commentary: postwar period: 30% of the final mark.

## BIBLIOGRAPHY

**Basic:**
- Billington, David P. La Torre y el puente : el nuevo arte de la ingeniería estructural. Madrid: Cinter Divulgación Técnica, cop. 2013. ISBN 9788493930547.
- Colquhoun, Alan. La arquitectura moderna : una historia desapasionada. Barcelona: Gustavo Gili, 2005. ISBN 8425219884.
- Montaner, Josep Maria. Después del movimiento moderno : arquitectura de la segunda mitad del siglo XX. 4a. Barcelona: Gustavo Gili, 1999. ISBN 8425217822.
- Strike, James. De la construcción a los proyectos : la influencia de las nuevas técnicas en el diseño arquitectónico, 1700-2000. Barcelona: Reverté, 2004. ISBN 8429121013.
- Paricio Ansuategui, Ignacio. Construcciones para iniciar un siglo . Barcelona : Bisagra, 2000. ISBN 8493132004.

**Complementary:**
- Ábalos, Iñaki; Herreros, Juan. Técnica y arquitectura en la ciudad contemporánea, 1950-2000. Madrid: Nerea, 2000. ISBN 8486763746.
- Addis, William. Building : 3000 years of design engineering and construction. London: Phaidon, 2007. ISBN 9780714841465.
- Banham, Reyner. La Arquitectura del entorno bien climatizado. Buenos Aires: Infinito, 1975.
- Domouso, Francisco José (ed.). Arquitectura e ingeniería. Madrid: Fundación COAM, 2007. ISBN 9788496656277.

- Petroski, Henry. La Ingeniería es humana : la importancia del fallo en el éxito del diseño. Madrid: Cinter, 2007. ISBN 9788493227029.
- Margolius, Ivan. Architects + engineers : structures. Chichester: Wiley-Academy, cop. 2002. ISBN 0471498254.
- Torroja, Eduardo; Torroja, José Antonio. Razón y ser de los tipos estructurales. Madrid: CSIC, 2007. ISBN 9788477904564.

## RESOURCES

**Audiovisual material:**
- Arquitectures de Barcelona: Mirall urbà, set mirades = Arquitecturas de Barcelona: Espejo urbano, siete miradas = Architecture in Barcelona: Urban mirror, seven looks [video recording]. https://youtu.be/3Q3CfOHQfe0

**Hyperlink:**
- structurae : International Database and Gallery of Structures. https://structurae.net/