西安交通大学《建筑技术工坊-1》课程教学大纲

一、课程基本信息

I. Basic Information

课程名称 Course Title	建筑技术工坊-1 Building Technology Studio-1 —Technology Design Architecture		
课程编号 Course Number			
课程学分 Credits	4	总学时 Credit Hours	64
学时分配 Assignment of Credit Hours	理论: 64 实验: 上机: 课外:____ （课外学时不计入总学时） Lecture:9.6 Studio:9.6 Practice in the IT room:44.8 Extracurricular:____ (Extracurricular hours do not count towards the total number of hours.)		
课程类型	□公共课程 Public Course □通识课程 General Education Course □学科门类基础课 □专业大类基础课 ☑ 专业核心课 Specialized Core Course □专业选修课 Specialized Elective Course □集中实践 Intensive Practice		
开课学期	□1-1 □1-2 ☑ 2-1 □2-2 □3-1 □3-2 □4-1 □4-2 □5-1 □5-2		

先修课程 Prerequisites	n/a
教材、参考书及其他资料 Materials (Textbook, Bibliography or Referencing and Supplementary Materials)	[1] Ching F. D.K., Building construction illustrated - Sixth Edition, Wiley, 2020, ISBN: 9780470087817 [2] St Hill C., This is Temporary: How Transient Projects are Redefining Architecture, RIBA Publishing, 2019, ISBN: 9781000702361 [3] Deutsch R., Data-Driven Design and Construction: 25 Strategies for Capturing, Analyzing and Applying Building Data, Wiley, 2015, ISBN: 9781118898703 [4] Silver P., McLean W., Introduction to Architectural Technology, Paperback, 2013, ISBN: 978-1780672946 [5] Emmit S., Architectural technology, Wiley-Blackwell, 2012, ISBN: 978-1-405-19479-2 [6] Kohler N., König H., Kreissig J., Lützkendorf T., A life cycle approach to buildings, Institut für international Architektur Documentation, 2010, ISBN: 9783920034454

二、课程目标及学生应达到的能力

II. Course Objectives and Expected learning outcomes

（工科专业对标工程教育认证标准中专业毕业要求的 12 条具体指标点，其他专业对标行业/评估标准中专业毕业要求的具体指标点）

Course objectives

The aim of the Studio is to experiment with the complexity of the design, from the idea to the realization, by acquiring knowledge about the ways of controlling the relationships between technological, energetic, environmental and structural aspects, and the experimentation and innovation paths of techniques, processes and how to design the project.

The Studio aims to illustrate the cognitive, methodological, organizational and procedural tools in the different stages of the building process aimed at the constructability of complex new architectural interventions or the redevelopment of the existing one. Particular attention in the Building Technology Studio is reserved for functional, constructive and environmental choices from the early stages of the project. The course intends to push the designing of "time-based" architecture and structures; the main functions of housing, sport and events will be considered. Xi'an metropolis will be the real context where students will be able to experiment with a novel design process.

The course proposes a design & construction innovative path of “performative information modelling”, in the way the teachers are willing to encourage students to take a new approach of architectural designing, based on the choice of materials and their performance, as well as their capability of structuring and defining the whole architectural shape. The latter must derive from the appropriate use of materials, based on their resistance and durability (time-based structures). Only in this way will the designer be able to conceive sustainable buildings, that is, buildings that save materials and last over time, exactly for a duration that society and the designers have decided that the work should serve, adapt, transform itself, be abandoned and die, or be transformed into something new, similar to the living organisms of the planet.

Furthermore, the students will face the issue of durability of building materials and products, and they will learn how a) make the building more efficient and long-lasting, thanks to the well-designed interfaces between different materials; b) coherently match the right materials with the expected durability of the building system, avoiding the anticipated waste of durable resources.

Summing up:

Part 1 Fundamentals of Architectural Technology and Systems Design

- 1A (Lecture and Studio) _ Lectures (5%) and exercises (4.5%) on Architectural Technology and Systems Design
- 1B (IT room) _ Schematic Design Workshop: project scale: 1:500, 1:200, 1:100 (23.3%)

Part 2 Fundamentals of Sustainable Design and Reversible Construction

- 2A (Lecture and Studio) _ Lectures (5%) and exercises (6%) on Sustainable Design and Reversible Construction
- 2B (IT room) _ Detailed Design Workshop: project scale: 1:100, 1:50, 1:20 (23.3%)

Part 3 Fundamentals of Construction Design

- 3A (Lecture and Studio) _ Lectures (5%) and exercises on Construction Design and (one or more, according to class reactions) intro to parametric modeling, data acquisition, 3D prototyping (4.5%)
- 3B (IT room) _ Construction Design Workshop: project scale: 1:20, 1:10, 1:5 (23.3%)

Expected learning outcomes

Expected learning outcomes are the ability to develop a feasibility and constructability project, such as: (i) the design capacity of the constructive dimension, the constraints related to the environmental, physical, regulatory and cultural context in which the intervention is located; (ii) the ways of use; (iii) coordinated and interdisciplinary management of the technological, structural and energetic-environmental themes that form the project on the basis of priority requirements; (iv) anticipating decisions and evaluating the different technical options available today; (v) application of the tools to support project decisions. According to the Dublin Descriptors (DdD), passing the exam certifies the acquisition of the following results:

- DdD 2 (ability to apply knowledge and understanding):
    - ability to develop projects that are attentive to the constructive dimension, to the constraints related to the environmental, physical, normative and cultural context in which the

intervention is located, to the usability and to the verification of the technical feasibility.

  - ability to govern the complexity of the project, from the conceptual phase to the implementation phase.

- DdD 3 (autonomy of judgment), 4 (communication skills) and 5 (learning ability):
  - ability to operate and communicate independently the design choices made.

课程目标与专业毕业要求的关联关系

Correlation between course objectives and graduation requirements for the program

毕业要求：

Graduation Requirements

Students of this major should meet the following graduation requirements in terms of knowledge, ability and calibre.

A. Possess broad theoretical knowledge of humanities and social sciences and natural sciences, strong scientific literacy, humanistic and artistic dispositions, and sound physical and mental well-being.

B. Have solid theoretical knowledge related to architecture, master the basic principles of architectural design, history and theory of architecture, architecture and behaviour, the safety of architecture, building structure,

building materials and construction, control of the physical environment of buildings, urban and rural planning and landscape design, economy and regulations, systems and professional codes, responsibilities of architects and other related knowledge.

C. Have the methods and skills of architectural design and related planning design, master the process and methods of architectural design and have a strong ability to express and practice architectural design, as well as good creative thinking and artistic creation ability and the ability to analyze problems and solve them comprehensively.

D. Have an international open vision and the ability to communicate, compete and cooperate across cultures.

毕业要求 / 课程目标	A	B	C	D
1A	M	M	H	M-H
1B	M	M	H	M-H
2A	M	M	H	M-H
2B	M	M	H	M-H
3A	M	M	H	M-H
3C	M	M	H	M-H

注：毕业要求中 A、B、C、D、E、F、G、…对应毕业要求中各项具体内容。课程目标与专业毕业要求的关联关系用 H/M/L 标注。

Note: A, B, C and D indicate the specific aspects of the graduation requirements. H, M and L refer to a strong, medium and weak correlation between the course objectives to the graduation requirements respectively.

三、教学内容简介

III. Description of teaching contents

章节顺序	章节名称 Chapter Title	知识点 Teaching Points	参考学时 Credit Hours
1A	Fundamentals of Architectural Technology and Systems Design	This Chapter aims at introducing the students to the complexity of the design process of a building, from the concept and briefing stage to the development of the documents needed to communicate design information to the construction stage. This requires a good understanding of the processes of design and construction necessary for the development of the built environment, where the needs, values and objectives of the client, the users and the community must be reconciled to the characteristics of the building itself and of its embedded values. The Chapter will mainly relate to construction techniques, materials, spaces, performances and values that represent an actual resource which must be carefully and thoroughly evaluated in the design process.	5% (lesson) = 3,2 hours
2A	Fundamentals of Sustainable Design and Reversible Construction	Chapter 2 deals with the rational use of energy and materials in the construction process, with the aim of reducing its environmental impacts and carbon footprint. Lectures will introduce to the Life Cycle Analysis applied to the built environment, that is nowadays indispensable not only for new buildings, which have already been regulated for some years according to increasingly stringent environmental standards (NZEB, almost zero energy buildings), but also for the redevelopment and recovery of the existing building stock, which must be quickly	5% (lesson) = 3,2 hours

		brought back to levels of consumption and emissions compatible with the vision of a future freed from dependence on fossil fuels.	
3A	Fundamentals of Construction Design	One or more of the following tasks: – Technological design for the construction stage – Parametric design – Energy modeling – 3D prototyping	5% (lesson) = 3,2 hours

四、教学安排详表

IV. Teaching Arrangements

序号	**教学内容** Teaching contents	**学 时分配** Credit Hours	**教学方式** Teaching Methods	**教学要求（知识要求及能力要求）** Learning Objectives (knowledge objective & ability objective)	**对课程目标的支撑关系** Related to which Course Objective
1	Technological design architecture	3% (exercise) = 1,92 h	Practical exercises	The task focuses on the identification of the criteria that must be taken during the design phase to direct the choice between different technical options, paying close attention to the social, physical, productive and economical context. During the practical exercises, students will be asked to study the articulated scenery of resources and construction systems of nowadays, with particular care to performances and mutual relationships within the building systems.	1
2	Building components and systems design	3% (exercise) = 1,92 h	Practical exercises	Students will be encouraged to have practice with lightweight materials and off-site construction techniques as much as possible, with the aim to optimize the materials' quantities embedded into the buildings and to design more efficient and environmentally compatible structures.	1 - 2

3	Life cycle design	3% (exercise) = 1,92 h	Practical exercises	During the development of the projects the students will learn to choose appropriate materials and construction technologies, to limit the environmental impact and to guarantee greater comfort and quality to the designed spaces.	2
4	Design for disassembly-reusing-remanufacturing	3% (exercise) = 1,92 h	Practical exercises	Students will study how the reversibility and the re-usability of parts of the building could become a design strategy since the early-stage design process, while the architecture and its structural components will have to be developed in close relation with the time of their expected service life.	2 - 3
5	Advances	3% (exercise) = 1,92 h	Practical exercises	The task focuses on the acquisition of the fundamental principles that regulate the design of construction details. According to the class reaction, students can also have practices with one or more digital tasks that relate to the performative design and the 3D prototyping of a specific part of the technological system that they will design within this studio. The main tasks are listed below: – Technological design in BIM environment – Energy modeling – Generative design – 3D prototyping	3

注：对课程目标的支撑关系可填写大纲中第二部分课程目标的相应序号。

The column *Related to which Course Objective* can be filled in with the number of the corresponding course objective in Part II.

五、实践环节

V. Studio/Lab

实验编号 No.	实验名称 Subject Name	实验内容 Contents	教学方法 Teaching Methods	**对课程目标的支撑关系** Related to which Course Objective
1B	Schematic Design (project scale: 1:500, 1:200, 1:100)	The design proposal will be developed through the control stage of the technical regulation (form, space, structure, etc.) and detailed construction drawings, specifications and plastic models. Beyond studio work, which will represent the main activity, some important issues will be further developed in lectures and seminars (also by the presentation of case studies) about the architectural use of buildings materials, constructions systems, the life cycle assessment, the structural systems, the rational use of energy, renewable energy and environmental impact, the principles of structural design in the context of analysis of a building, the integration of different disciplines within the architectural design of a building.	23,3% Design Workshop = 14,9 hours	1
2B	Detailed Design (project scale: 1:100, 1:50, 1:20)		23,3% Design Workshop = 14,9 hours	2
3B	Construction Design (project scale: 1:20, 1:10, 1:5)		23,3% Design Workshop = 14,9 hours	3

注：对课程目标的支撑关系可填写大纲中第二部分课程目标的相应序号

The column *Related to which Course Objective* can be filled in with the number of the corresponding course objective in Part II.

六、课外学时分配

VI. Extracurricular Practice

章节顺序	内容 Contents	参考学时 Credit Hours	**对课程目标的支撑关系** Related to which Course Objective
1	n/a	n/a	n/a

…			

注：对课程目标的支撑关系可填写大纲中第二部分课程目标的相应序号。

七、考核方式及成绩构成

VII. Evaluation and Composition of Grades

Student activities will be carried out in groups of 2-3 people and will be developed in 3 phases: Schematic design, Detailed Design and Construction Design. Each phase corresponds to specific training activities and three mid-term project advancements and will end with a presentation of the works. The Professor will discuss the projects, giving students shared suggestions and intermediate evaluations, based on the coherence between pre-established goals and the levels of acquired cultural awareness. The final exam will be a significant moment of critical argumentation and constructive discussion of the project design, where each student will have to demonstrate:

1. ability in the cognitive and interpretative procedures of spatial and cultural contexts.
2. in-depth disciplinary knowledge of theories and techniques of complex constructions.
3. ability to apply integrated structural, constructive solutions to the expressive and formal choices of architecture.
4. methodological coherence throughout the design process, from the conception to its technical and formal development.

5. ability to argue and critically expose the project through the most effective drawings and models.

平时：10%，(包含：xxxx)

实验（上机)：40%；(包含：xxx)

期末：50%

e.g. 10% for usual performance (including attendances),

40% for mid-term examinations (including project advancement evaluations and mid-term practical exercises)

and 50% for final examinations.

<本部分构成及考试方式可根据具体课程定制> Depending on the course

大纲制定者：× × ×

This syllabus was developed by _____

大纲审核者：× × ×

This syllabus was reviewed by _____

最后修订时间：_____年___月___日

Date of the final revision of the syllabus _____(yyyy/mm/dd)