1. BASIC INFORMATION

Course	Building Facilities
Degree program	Degree in Fundamentals of Architecture
School	School of Architecture, Engineering and Design
Year	Third year
ECTS	6 basic ECTS (150 hours)
Credit type	Compulsory
Language(s)	English
Delivery mode	Campus-based
Semester	First semester
Academic year	2025/26
Professor	Francisco Javier Avilés Montes

2. PRESENTATION

Building services have a very important role in every kind of building; thus, its learning is vital during the training of an architect. Thinking architecture without considering installations would mean the failure of a project; that is why the main target of the subject Building Facilities is to form the students both in design and calculation aspects, both manually and using software, so they achieve the necessary knowledge to succeed during their professional activity.

From a teaching point of view it is indispensable not to focus only in a theoretical area, but to complement it with the self- investigation of the student, and especially with the solving of exercises that relate the achieved knowledge with the reality of professional activity, and therefore helping to secure the rote knowledge. Consequently, during the year the students will apply their theoretical knowledge to practical cases, proposing, designing and calculating different kinds of building services, selecting the necessary systems, materials and products to satisfy the current technical regulations.

3. COMPETENCIES AND LEARNING OUTCOMES

Basic Competencies (CB):

1. Students should have demonstrated to have and understand their general secondary education studies related to their area, which is usually found in a level that, although based on advanced textbooks, includes some of the cutting-edge aspects of their studies as well.

2. Students should know how to make use of their knowledge in their work or vocation in a professional way and have the competences usually demonstrated through the development and defense of arguments and the solution of problems within their study area.

3. Students should have the capacity of gathering and interpreting relevant facts (usually within their study area) to emit personal opinions and critical reflections about relevant social, scientific or ethical facts.

4. Students should be able to convey information, ideas, problems and solutions both to specialized and non-specialized public.

5. Students should have developed the necessary learning abilities to understand further studies with a high level of autonomy.

General Competencies (CG):

4. Understand the structural conception, construction and engineering problems bound to building projects, as well as their resolution techniques.

5. Know the physical problems, the different technologies and the function of buildings, so that these are provided with internal comfort conditions and protected from climatic factors.

6. Know the industries, organizations, regulations and procedures for building projects and integrate their planning.

7. Understand the relationship between people and buildings, and that between these and their environment as well as relating them to the spaces among them based on human scale and needs.

Transverse competencies (CT):

1. Responsibility: Ability or capacity to face the responsibility to realize the role an architect plays in society, specially working out projects that consider social and environmental factors.

2. Self-confidence.

3. Awareness of ethical values: Ethical commitment including the understanding and knowledge of the rights and obligations of people and professionals, encouraging human rights, the protection of the weakest social sectors and the respect to environment

4. Communicative mother-tongue skills (both oral and written) and in English, any concept or specification, including specific vocabulary, related to the standardized profession of Architect, according to the principles of Universidad Europea de Madrid. This ability includes the capacity of managing information.

5. Interpersonal comprehension.

6. Flexibility.

7. Teamwork: Capacity to work in groups of architects or interdisciplinary (with shared responsibility) managing and planning the necessary teams for the competences defining a project of a certain significance in which different disciplines converge. This capacity includes the abilities for interpersonal relationships and the capacity for leading teams.

8. Initiative and entrepreneurship, both in the architectural and business fields.

9. Planning and managing time. Capacity to plan work as needed for delivering within time and respecting the budgetary factors and the regulations of the construction application.

10. Innovation and creativity. Creativity, imagination and aesthetic sensitivity fixed on design, fulfilling the aesthetic and technical requirements. This competency includes critical reasoning and historical culture.

Specific Competencies (CE):

9. Appropriate knowledge applied to the architecture and urbanism of the principles of fluid mechanics, hydraulic, electricity and electromagnetism.

13. Aptitude to apply the technical and structural regulations.

20. Capacity to conceive, calculate, design and integrate in buildings and urban compounds and undertake the installations for supply, treatment and evacuation of water, heating and air-conditioning.

23. Capacity to preserve installations.

31. Knowledge of measurement, assessment and valuation methods.

37. Capacity to conceive, perform and develop basic and performance projects, sketches and drafts.

52. Adequate knowledge of ecology, sustainability and preservation of energetic and environmental resources.

SPS (Student Performance Criteria) Competencies, NAAB:

A.11. Applied Research: Understanding the role of applied research in determining function, form, and systems and their impact on human conditions and behavior.

B. 5. Life Safety: Ability to apply the basic principles of life-safety systems with an emphasis on egress.

B. 11. Building Service Systems: Understanding of the basic principles and appropriate application and performance of building service systems such as plumbing, electrical, vertical transportation, security, and fire protection systems.

The following table shows the relationship between the competencies developed during the course and the learning outcomes pursued:

Competencies	Learning outcomes
CB1, CB2, CB4, CG4, CG5, CT1, CT3, CT4, CT5, CT6, CT7, CT9, CE52	RA1 - Comprehension of the inside functioning of buildings and their building facilities depending their use.
CB2, CG5, CT1, CT3, CT4, CT5, CT6, CT9, CE9, CE20, CE37	RA2 - Capacity of designing, calculating and integrating water supply systems, air-conditioning systems, electrical systems, artificial lighting systems, solar thermal and photovoltaic systems.
CB2,CB4, CG5, CT1, CT3, CT4, CT5, CT6, CT9	RA3 - Comprehension and basic knowledge of the installation components, materials, equipment, etc.
CB2, CB3, CB4, CG6, CT1, CT3, CT4, CT5, CT6, CT7, CT9, CE20	RA4 - Ability to propose building service systems.

CB2, CB3, CB5, CG7, CT1, CT3, CT4, CT5, CT6, CT9, CT10, CE13	RA5 - Capacity of developing building services, to direct them during the construction process, to check their ability to function, and to maintain them.
CB2,CB3, CB5, CG6, CT1, CT3, CT4, CT5, CT6, CT7, CT9, CT10, CE13, CE52	RA6 - Capacity of applying technical regulations and of producing technical documents and building-construction methodologies.
CB2, CB3, CB5, CG6, CT1, CT3, CT4, CT5, CT6, CT7, CT9, CT10, CE31	RA 7- Capacity of analyzing building facilities in projects in order to direct construction processes.
CB2, CB3, CB5, CG7, CT1, CT3, CT4, CT5, CT6, CT7, CT8, CT9, CT10, CE23, CE37, CE52	RA8 - Knowledge of the different building services, according to the use of the building, to its shape and its typology, to its structure and construction, and according to the outside climate conditions.

4. CONTENT

The learning units will be the next ones:

LU.01_INTRODUCTION TO BUILDING SERVICES

Historical evolution of building services.
Previous considerations.
Main aspects about building installations: water supply, electricity, telecommunications, air-conditioning, heating, DWV, ventilation, HVAC, gas, lifts, etc.
Needed spaces and shafts.
Transport installations.
Integration between building facilities and construction/structural elements.
The cost of installations.
Maintenance and pathologies of building services.
Adaptation processes and effectiveness applied to buildings.

LU.02_COLD WATER SUPPLY SYSTEMS

Basic regulations.
Plumbing connection for subscribers.
General installation.
Individual derivations.
General aspects, problems and design of water supply systems.
Components of a cold water supply system.
Calculations and sizing.
Examples.

LU.03_HOT WATER SUPPLY SYSTEMS AND SOLAR PANELS

Basic regulations.
General aspects and classification of cold water supply and production systems.
Components.
Distribution systems.
Calculations and sizing.
Individual and centralized production.
Solar thermal systems.
Examples.

LU.04_DRAIN-WASTE-VENTILATION SYSTEMS

Basic regulations.
General aspects, problems and classification of DWV systems.
Components.
Materials.
Design.
Calculations and sizing.
Sanitary elements – properties and selection criteria.
Examples.

LU.05_FIRE SECURITY – LIFE SAFETY

Basic regulations.
General aspects.
Material classification.
Types of fire.
Transmission and effects of fire.
Fire loads.
Inside propagation.
Outside propagation.
Emergency evacuation.
Fire protection installations.
Firemen action.
Examples.

LU.06_ELECTRICAL SUPPLY AND TELECOMMUNICATION SYSTEMS

Basic regulations.
Other compulsory rules.
Design and calculation.
Examples.

5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:

- Master class.
- Directed work.
- Case-study.
- Cooperative learning.
- Problem-based learning.
- Project-based learning.

6. LEARNING ACTIVITIES

Listed below are the types of learning activities and the number of hours the student will spend on each one:

Campus-based mode:

Learning activity	Number of hours
Lecture-based classes	12,5 h
Directed study, labs and problem-solving	50 h

Presentation of projects, oral defense	12,5 h
Group work	25 h
Independent study	15 h
Advisory sessions, ongoing assessment and exams	25 h
Laboratory practice	0 h
Internship	0 h
TOTAL	**150 h**

The use of artificial intelligence tools is permitted on a complementary and limited basis, provided that their use does not replace the student's active learning process or compromise the individual authorship of the work submitted. These tools may be used, among other functions, to assist in the drafting of reports exclusively for improving the linguistic and technical quality of the text, for the production of non-technical supporting graphic material (such as illustrative images, diagrams or conceptual schemes), and for translating texts between different languages. The generation of introductions, conclusions or critical analyses, even if informed by AI-generated content, must be written entirely by the student.

The use of AI tools to automatically generate substantial parts of any required assignments or coursework is not permitted, nor may they be used to produce content that should reflect the student's own reasoning, technical ability, or critical judgment. Likewise, it is not acceptable to submit as original any AI-generated material that has not been thoroughly reviewed, understood, and adapted by the student to the specific context of the assignment.

The use of these tools does not exempt students from mastering the required technical knowledge or from correctly developing and presenting the assigned work and exercises. Teaching staff may request, at any time, a reasoned explanation of the submitted content, as well as evidence of the student's working process. Improper or fraudulent use of AI tools may result in the invalidation of the assignment, in accordance with applicable academic regulations.

With regard to written examinations, the use of AI tools is strictly prohibited during the exam. However, such tools may be used beforehand as a study aid — for instance, to create outlines, summaries or sample questions — provided that this use supports, rather than replaces, the student's personal study and genuine understanding of the course content.

7. ASSESSMENT

Listed below are the assessment systems used and the weight each one carries towards the final course grade:

Campus-based mode:

Assessment system	Weight
Final exam	20%
Cases/Problems	70%
Achievement monitoring	10%

When you access the course on the *Campus Virtual*, you'll find a description of the assessment activities you have to complete, as well as the delivery deadline and assessment procedure for each one.

7.1. First exam period

To pass the course in the first exam period, you must obtain a final course grade of at least 5 out of 10 (weighted average) and a minimum mark of 4 out of 10 in each part.

In any case, you will need to obtain a grade of at 4.0 in the final exam in order for it to count towards the final grade along with all the grades corresponding to the other activities.

7.2. Second exam period

To pass the course you must obtain a final grade of at least 5 out of 10 in the extraordinary call exercise.

8. SCHEDULE

This table shows the delivery deadline for each assessable activity in the course:

Assessable activities	Deadline
LU.01_INTRODUCTION TO BUILDING SERVICES	WEEK 1-3
LU.02_COLD WATER SUPPLY SYSTEMS	WEEK 4-5
LU.03_HOT WATER SUPPLY SYSTEMS AND SOLAR PANELS	WEEK 6-7
LU.04_DRAIN-WASTE-VENTILATION SYSTEMS	WEEK 8-9
LU.05_FIRE SECURITY – LIFE SAFETY	WEEK 10-11
LU.06_ELECTRICAL SUPPLY SYSTEMS	WEEK 12-13
OTHERS	WEEK 14-END

This schedule may be subject to changes for logistical reasons relating to the activities. The student will be notified of any change as and when appropriate.

9. BIBLIOGRAPHY

GENERAL BIBLIOGRAPHY

- Installations in Buildings. Edwin Wellpont. GG. 2009.
- Building Services Handbook. Fred Hall & Roger Greeno. 4th Edition. 2007.
- Building Services Engineering. David V. Chadderton. 5th Editiom. 2007.
- Números Gordos en el Proyecto de Instalaciones. Javier Vázquez Moreno. 1ª Edición.2012.
- Abecé de las Instalaciones. Javier Vázquez y Juan Carlos Herranz.1ª Edición. 2012.

DWV AND WATER SUPPLY

- Código Técnico de la Edificación. Ministerio de la Vivienda. 2013. (RD 314/2006 de 17 de marzo).
- RITE + Instrucciones Técnicas Complementarias. RD 1027/2007 20 de julio (BOE nº 207, 29 de agosto 2007).
- Resumen de Normas UNE.
- Instalaciones de Fontanería, Saneamiento y Calefacción. Franco Martín Sánchez. 4ª edición. 2007.
- Cálculo y normativa básica de las instalaciones en los edificios. J.L. Arizmendi Barnes. Ed.: Eunsa. 6ª edición. 2000.
- Nuevo Manual de Instalaciones de Fontanería y Saneamiento. Franco Martín. Ed. A. Vicente 2007.
- Instalaciones en la edificación y su ejecución. E. Maestre Gordo; J.A. López Davó. Gabinete Técnico del COAATMU. 2001.
- Instalaciones de fontanería. M. Roca Suárez, J. Carratalá y J. Solís Robaina. Univ. De las Palmas de Gran Canaria. 2005.
- Instalaciones sanitarias. Pedro Mª Rubio Requena. 1974.
- Manuales técnicos ROCA.
- Pliego de especificaciones técnicas para tuberías. Serie normativa 2001.
- NTE. Instalaciones 1ª Parte. Ministerio de Fomento. 2002.
- NTE. Instalaciones 2ª Parte. Ministerio de Fomento. 2002.
- Manual de instalaciones de calefacción por agua caliente. Franco Martín
- Sánchez. AMV ediciones. 3ª edición. 2008.
- Cálculo y normativa básica de las instalaciones en los edificios. J.L. Arizmendi Barnes. Ed.: Eunsa. 6ª edición. 2000.
- Nuevo Manual de Instalaciones de Fontanería y Saneamiento. Franco Martín. Ed. A. Vicente 2007.
- Instalaciones de fluidos en los edificios. Saneamiento. A. Ayala. C.O.I.T.M.U. y Universidad Politécnica de Valencia. 2001.
- Instalaciones sanitarias. Pedro Mª Rubio Requena. 1974.
- Catálogo comercial Uralita. 2007.
- Catálogos comerciales

ELECTRICITY

- Normativa específica Iberdrola.
- Guía Técnica de Aplicación REBT. Consultoría y Documentación Digital S.L., Valencia, 2004
- J.L. Arizmendi Barnes. Cálculo y Normativa de las Instalaciones en la Edificación. Ed. Tebar, 2000.
- J. A. Sánchez Carrasco. Instalaciones eléctricas. Arquitecto.
- Catálogos comerciales. Legrand, Merlin Gerin, Cahor Española, GE Electric.
- Ministerio de Ciencia y Tecnología. Reglamento Electrotécnico de Baja Tensión. Ed. Paraninfo, Madrid, 2002.
- UNESA. Asociación Española de la Industria Eléctrica.
- G. Monzón Merencio, J. Moreno Gil, C. Fernández García. Manual Técnico del Electricista. PLC, Madrid, 2004.
- Schneider Electric. Manual Teórico-Práctico Schneider. Instalaciones en Baja Tensión.
- E. Carrasco Sánchez. Instalaciones Eléctricas de Baja Tensión en Edificios de Viviendas. Ed. Tebar, Madrid, 2008.
- F. Martín Sánchez. Nuevo Manual de Instalaciones Eléctricas. Ed. A. Madrid Vicente, Madrid, 2003.

LIGHTING

- Manual Práctico de Iluminación. Franco Martín. Ed. A Martín Vicente.1ª Edición. 2005.

HVAC

- El Proyecto de Instalaciones de Climatización. Miguel Ángel García. 2012.
- Manual de Instalaciones de Calefacción por Agua Caliente. Franco Martín Sánchez. 3ª Edición. 2008.
- Real Decreto 1027/2007, de 20 de julio, por el que se aprueba el Reglamento de Instalaciones Térmicas en los Edificios.

10. DIVERSITY MANAGEMENT UNIT

Students with specific learning support needs:

Curricular adaptations and adjustments for students with specific learning support needs, in order to guarantee equal opportunities, will be overseen by the Diversity Management Unit (UAD: Unidad de Atención a la Diversidad).

It is compulsory for this Unit to issue a curricular adaptation/adjustment report, and therefore students with specific learning support needs should contact the Unit at unidad.diversidad@universidadeuropea.es at the beginning of each semester.

11. ONLINE SURVEYS

Your opinion matters!

The Universidad Europea encourages you to participate in several surveys which help identify the strengths and areas we need to improve regarding professors, degree programs and the teaching-learning process.

The surveys will be made available in the “surveys” section in virtual campus or via e-mail.

Your assessment is necessary for us to improve.

Thank you very much for your participation.