



## 1. General information

**Course:** BUILDING INSTALLATIONS II

**Type:** CORE COURSE

**Degree:** 315 - UNDERGRADUATE DEGREE IN BUILDING ENGINEERING

**Center:** 308 - SCHOOL POLYTECHNIC OF CUENCA

**Year:** 3

**Main language:** Spanish

**Use of additional languages:**

**Web site:** <https://campusvirtual.uclm.es/>

**Code:** 59320

**ECTS credits:** 6

**Academic year:** 2022-23

**Group(s):** 30

**Duration:** First semester

**Second language:**

**English Friendly:** Y

**Bilingual:** N

**Lecturer:** JOAQUIN FUENTES DEL BURGO - Group(s): 30

| Building/Office                       | Department                              | Phone number | Email                   | Office hours   |
|---------------------------------------|---|--------------|-------------------------|--|
| Escuela Politécnica.<br>Despacho 2.03 | INGENIERÍA CIVIL Y DE LA<br>EDIFICACIÓN | 4838         | joaquin.fuentes@uclm.es | The tutorial schedule will be published on the bulletin board, on the subject's Moodle Platform and on the office door 2.03. |

## 2. Pre-Requisites

It is recommended that the student enrolls in the subject when he has passed the following subjects:

Mathematics Fundamentals I

Mathematics Fundamentals II

Physics Fundamentals I

Physics Fundamentals II

Architectural Drawing I

Construction Materials

Construction I

Construction II

Construction III

Building Facilities I

## 3. Justification in the curriculum, relation to other subjects and to the profession

This subject, eminently technological, should make known, study and evaluate, within the time possibilities of the curriculum, the answers that man has provided to the establishment and control of different internal environmental conditions, influencing these conditions on:

- Survival and safety (protection against fires, electric shocks, intrusions, etc.).
- Health (quality of air, water, hygiene and sanitation, etc.).
- Performance and comfort (visibility, climate comfort, hearing, movement and transport of people and things, etc.).

Nowadays we can not understand a building without the basic services of water supply, drainage and sanitary, electricity, lighting, air conditioning, telecommunications, etc. While the structure is the skeleton and the envelope the skin, the facilities constitute the circulatory system (energy, fluids, information, etc.).

In this field there are continuous technological developments, standards and standards changes that condition the work of professionals dedicated to the project, assembly, maintenance and control of building facilities, which leads to a practical study and a systematic check of the facts as basic work tool, without doubting or disregarding the theoretical flow of information necessary to understand and analyze the processes described.

The actions that at professional level have relation with the facilities can be very varied. In the preliminary study of the project of a building whose execution will be directed, the Building Engineer must recognize and differentiate the projected facilities, relating them to the rest of the construction, visualizing the building as a body. In this phase, the necessary construction details for the execution of the installations will be prepared or planned, looking for the solutions that best suit the structural and constructive configuration of the building. During the construction of the building they must have the necessary knowledge to supervise, control and plan the assembly work, as well as the tests and inspections that have to be carried out on the assembled installations.

For these tasks, the Building Engineer needs to know and know how to apply the regulations and regulations that govern the different types of facilities. It should not be forgotten that many of these regulations have a marked technical nature, a situation that requires a minimum level of theoretical knowledge to understand and apply properly.

Considering all the above, it is essential to know the intrinsic functioning of the facilities, in order to know which objective and function meet the elements that compose it, its calculation and sizing. In this way, it will be possible to analyze the designs whose execution has to be supervised, as well as to be able to carry out own designs in the realization of projects, within the competences of the knowledge and profession of the Building Engineer.

Knowing the materials used in the realization of the facilities acquires a vision of the behavior of the same, not only during its assembly, but during its operation;

the precautions that must be taken when assembling them, the incompatibility between materials and their installation conditions. In addition, it will be possible to plan and take control of the maintenance of the installations executed in buildings, a task that is becoming increasingly relevant in this field.

In addition, the Building Engineer must know how to perform the analytical calculations of the different facilities, as well as the management of abacuses and tables for the calculations and verifications that have to be carried out in the design phases or in the evaluation of solutions on site, as well as in the solution of the deficiencies that may exist at the project level.

General and specific software will be used as tools for sizing facilities, supported by the knowledge necessary to verify the results obtained. The computers are considered complementary accessories for the engineer, they do not substitute it, they revalue it, making it more essential, but demanding a concise knowledge of the operation of the facilities.

In the course will try to reach a balance between the knowledge of design, materials, systems, elements, execution, maintenance and sizing, because they are all related to each other.

| 4. Degree competences achieved in this course |  |
|---|--|
| Course competences                            |  |
| Code  | Description  |
| E20   | Knowledge of the evaluation of the environmental impact of the building and demolition processes, of the building sustainability, and of the procedures and techniques to evaluate the energy efficiency of the buildings. |
| E21   | Ability to apply technical regulations to the building process, and generate documents of technical specification of building procedures and construction methods.   |
| E22   | Ability to apply the specific regulations on facilities to the building process.   |
| E24   | Ability to constructively develop the building's facilities, control and plan their execution and verify the service and reception tests, as well as their maintenance.  |
| G01   | Ability for analysis and synthesis   |
| G04   | Problem resolution   |
| G05   | Decision making  |
| G06   | Critical thinking  |
| G07   | Teamwork   |
| G12   | Autonomous learning  |
| G15   | Sensitivity to environmental issues  |
| G18   | Initiative and entrepreneurial spirit  |
| G19   | Motivation for quality   |
| G21   | Command of Information and Communication Technologies (ICT)  |
| G22   | Correct oral and written communication   |

| 5. Objectives or Learning Outcomes   |
|--|
| Course learning outcomes   |
| Description  |
| Develop the ability to observe and analyze installations in the assembly phase or already executed, to increase the practical continuous training and the critical sense necessary for professional development. |
| Know the different components and basic elements that constitute the services as well as their intrinsic functioning.  |
| Know the materials used in the realization of the different services, studying their characteristics and the properties related to the application that is being given.  |
| Know and identify the systems that compose the fixed urban facilities and buildings.   |
| Apply the calculation methods in the sizing and evaluation of urban and building services.   |
| Know the execution systems of the services, as well as their control and their maintenance tasks.  |
| Use measuring devices applied to the control and operation verification of the services, as well as handle tools.  |
| Know and use the rules and regulations that govern the design, calculation, execution and control of the services.   |
| Understand the physical phenomena that govern the services operation.  |

| 6. Units / Contents   |
|---|
| <b>Unit 1: Electrical installations.</b>                                      |
| Unit 1.1 Supply and electrification of a building                             |
| Unit 1.2 Link facilities.   |
| Unit 1.3 Protection of electrical facilities.                                 |
| Unit 1.4 Design and execution of the facilities. Materials and mechanisms.    |
| Unit 1.5 Inside facilities.   |
| Unit 1.6 Grounding. Lightning rod installations. Lifting facilities           |
| Unit 1.7 Unit practices.  |
| <b>Unit 2: Infrastructure of telecommunication facilities in buildings.</b>   |
| <b>Unit 3: Heating systems and air conditioning installations.</b>            |
| Unit 3.1 Heating. Design conditions. Thermal loads.                           |
| Unit 3.2 Heating systems by hot water.  |
| Unit 3.3 Heat generation.   |
| Unit 3.4 Components of heating installations.                                 |
| Unit 3.5 Sizing of water networks.  |
| Unit 3.6 Radiant heating. Electric heating.                                   |
| Unit 3.7 Elementary psychrometric processes.                                  |
| Unit 3.8 Comfort conditions. Thermal loads in air conditioning installations. |
| Unit 3.9 Air conditions systems.  |
| Unit 3.10 Components of air conditioning systems.                             |

## ADDITIONAL COMMENTS, REMARKS

The order in which the units are taught, as well as their extension, will depend on the real hours available during the academic course.

| 7. Activities, Units/Modules and Methodology   |                                  |   |   |            |    |     |  |
|--|----------------------------------|---|---|------------|----|-----|--|
| Training Activity                              | Methodology                      | Related Competences (only degrees before RD 822/2021)   | ECTS  | Hours      | As | Com | Description  |
| Class Attendance (theory) [ON-SITE]            | Lectures                         | E20 E21 E22 E24 G01 G05 G15 G18 G19 G21                 | 1.04  | 26         | N  | -   | Theoretical-practical explanation in the classroom of the basic contents related to the different facilities of a building (at an urban level (to a lesser degree) and inside), using the methodology of the formal presentation of the contents and the use of the technique of the question.   |
| Problem solving and/or case studies [ON-SITE]  | Problem solving and exercises    | E21 E22 E24 G01 G04 G05 G06 G15 G18 G19 G21 G22         | 1.04  | 26         | N  | -   | Solving exercises and problems in a participatory way in the classroom.  |
| Laboratory practice or sessions [ON-SITE]      | Practical or hands-on activities | E21 E22 E24 G01 G04 G05 G06 G12 G19                     | 0.04  | 1          | Y  | N   | Execution of electrical assemblies and taking measurements of electrical circuits parameters. Use of devices for measuring the properties of humid air. The plagiarism of the reports resulting from the practices will be controlled and, in the event of irregularities, Article 9. Fraudulent performance of evaluation tests of the Student Evaluation Regulation of the University of Castilla-La Mancha.         |
| Computer room practice [ON-SITE]               | Practical or hands-on activities | E21 E22 E24 G01 G04 G05 G06 G07 G12 G15 G19 G21 G22     | 0.08  | 2          | Y  | N   | Realization of practices managing general programs (EXCEL) or specific to the modeling, design, analysis and / or dimensioning of facilities (cieBT or others). The plagiarism of the reports resulting from the practices will be controlled and, in the event of irregularities, Article 9. Fraudulent performance of evaluation tests of the Student Evaluation Regulation of the University of Castilla-La Mancha. |
| Final test [ON-SITE]                           | Assessment tests                 | E20 E21 E22 E24 G01 G04 G05 G06 G19 G22                 | 0.2   | 5          | Y  | Y   | Realization of the examination of the subject.   |
| Study and Exam Preparation [OFF-SITE]          | Self-study                       | E20 E21 E22 E24 G01 G04 G05 G06 G07 G12 G18 G19 G21 G22 | 3.6   | 90         | N  | -   | Study of the subject.  |
| <b>Total:</b>                                  |                                  |   | <b>6</b>                                    | <b>150</b> |    |     |  |
| <b>Total credits of in-class work: 2.4</b>     |                                  |   | <b>Total class time hours: 60</b>           |            |    |     |  |
| <b>Total credits of out of class work: 3.6</b> |                                  |   | <b>Total hours of out of class work: 90</b> |            |    |     |  |

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

| 8. Evaluation criteria and Grading System |                       |                            |   |
|---|-----------------------|----------------------------|---|
| Evaluation System                         | Continuous assessment | Non-continuous evaluation* | Description   |
| Laboratory sessions                       | 10.00%                | 10.00%                     | Each practice will be evaluated on 10 points. You must obtain a minimum score in each practice of 3 points. In case of obtaining a lower grade, the grade obtained will not be taken into account in the final grade of the subject.  |
| Final test                                | 80.00%                | 80.00%                     | It will be formed by two parts: Theory and Problems.<br>- Theory:<br>This part will be an exam composed by questions of type test (in this type of questions, every 3 incorrect answers will cancel a valid answer), and questions applied (of theoretical development and / or practical application).<br>-Problems:<br>This part has 2 or 3 problems.<br><br>At the beginning of the course the students will be informed if partial exams will be carried out and the conditions that will be imposed to pass the subject in case of doing them. The conditions of this modality will be published in computer support and paper, making it available to students. |

|  |                |                |  |
|--|----------------|----------------|--|
| Assessment of activities done in the computer labs | 10.00%         | 10.00%         | Each practice will be evaluated on 10 points.<br>You must obtain a minimum score in each practice of 3 points.<br>In case of obtaining a lower grade, the grade obtained will not be taken into account in the final grade of the subject. |
| <b>Total:</b>                                      | <b>100.00%</b> | <b>100.00%</b> |  |

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

#### Evaluation criteria for the final exam:

##### Continuous assessment:

Exam evaluation criteria

- Part of Theory (equivalent to 30% of the exam).

You must obtain a minimum qualification corresponding to 30% of the total qualification of this part to pass the exam

- Part of Problems (equivalent to 70% of the exam).

To pass the exam in each problem, you must obtain a minimum grade corresponding to 30% of the total score of the same.

It will be necessary to obtain a score equal or superior to 4 points in the exam to be able to add the qualification obtained in practices. In case of obtaining a grade below 4 points the exam will be considered suspended.

##### Non-continuous evaluation:

The student, who justifiably cannot attend the training activities regularly, must communicate it to the teacher of the subject at the beginning of the semester.

Exam evaluation criteria

- Part of Theory (equivalent to 30% of the exam).

You must obtain a minimum qualification corresponding to 30% of the total qualification of this part to pass the exam

- Part of Problems (equivalent to 70% of the exam).

To pass the exam in each problem, you must obtain a minimum grade corresponding to 30% of the total score of the same.

It will be necessary to obtain a score equal or superior to 4 points in the exam to be able to add the qualification obtained in practices. In case of obtaining a grade below 4 points the exam will be considered suspended.

#### Specifications for the resit/retake exam:

Exam evaluation criteria

- Part of Theory (equivalent to 30% of the exam).

You must obtain a minimum qualification corresponding to 30% of the total qualification of this part to pass the exam

- Part of Problems (equivalent to 70% of the exam).

To pass the exam in each problem, you must obtain a minimum grade corresponding to 30% of the total score of the same.

It will be necessary to obtain a score equal or superior to 4 points in the exam to be able to add the qualification obtained in practices. In case of obtaining a grade below 4 points the exam will be considered suspended.

In case of having suspended a practice, an exam of the practice / s may be carried out on the same dates and times established in the official examination session. The exam will evaluate the competences and skills contained in the practice.

#### Specifications for the second resit / retake exam:

Exam evaluation criteria

- Part of Theory (equivalent to 30% of the exam).

You must obtain a minimum qualification corresponding to 30% of the total qualification of this part to pass the exam

- Part of Problems (equivalent to 70% of the exam).

To pass the exam in each problem, you must obtain a minimum grade corresponding to 30% of the total score of the same.

It will be necessary to obtain a score equal or superior to 4 points in the exam to be able to add the qualification obtained in practices. In case of obtaining a grade below 4 points the exam will be considered suspended.

In case of having suspended a practice, an exam of the practice / s may be carried out on the same dates and times established in the official examination session. The exam will evaluate the competences and skills contained in the practice.

| 9. Assignments, course calendar and important dates  |              |
|--|--------------|
| Not related to the syllabus/contents   |              |
| Hours  | hours        |
| <b>General comments about the planning:</b> TThe temporary allocation to each topic will depend on the actual hours available and the evolution of teaching in the academic calendar. The order in which the topics are taught may vary depending on the development of the academic year. The planning of the subject, as well as the delivery dates of each of the evaluation activities, will be published on the virtual campus at the beginning of each semester. |              |
| <b>Unit 1 (de 3): Electrical installations.</b>  |              |
| <b>Activities</b>  | <b>Hours</b> |
| Class Attendance (theory) [PRESENCIAL][Lectures]   | 11.5         |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]  | 11           |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]   | 1            |
| Computer room practice [PRESENCIAL][Practical or hands-on activities]  | 2            |
| Final test [PRESENCIAL][Assessment tests]  | 2.4          |
| Study and Exam Preparation [AUTÓNOMA][Self-study]  | 35.5         |
| <b>Unit 2 (de 3): Infrastructure of telecommunication facilities in buildings.</b>   |              |
| <b>Activities</b>  | <b>Hours</b> |
| Class Attendance (theory) [PRESENCIAL][Lectures]   | 1            |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]  | 1            |
| Final test [PRESENCIAL][Assessment tests]  | .1           |
| Study and Exam Preparation [AUTÓNOMA][Self-study]  | 5            |
| <b>Unit 3 (de 3): Heating systems and air conditioning installations.</b>  |              |
| <b>Activities</b>  | <b>Hours</b> |
| Class Attendance (theory) [PRESENCIAL][Lectures]   | 13.5         |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]  | 14           |
| Final test [PRESENCIAL][Assessment tests]  | 2.5          |
| Study and Exam Preparation [AUTÓNOMA][Self-study]  | 49.5         |
| <b>Global activity</b>   |              |

| Activities  | hours |
|---|-------|
| Class Attendance (theory) [PRESENCIAL][Lectures]                                | 26    |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 26    |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]  | 1     |
| Computer room practice [PRESENCIAL][Practical or hands-on activities]           | 2     |
| Final test [PRESENCIAL][Assessment tests]                                       | 5     |
| Study and Exam Preparation [AUTÓNOMA][Self-study]                               | 90    |
| <b>Total horas: 150</b>   |       |

| 10. Bibliography and Sources                        |   |   |                             |      |      |             |
|---|---|---|-----------------------------|------|------|-------------|
| Author(s)   | Title/Link  | Publishing house  | City                        | ISBN | Year | Description |
| PAREJO, G.  | Electrificación de viviendas.   | Tebar   |                             |      |      |             |
| PIZZETTI, C.  | Acondicionamiento de aire y refrigeración.  | Bellisco.   |                             |      |      | Básico      |
| RECKNAGEL; SPRENGER ; HÖNMANN.                      | Manual técnico de calefacción y aire acondicionado.   | Bellisco  |                             |      |      |             |
| VALENTÍN LABARTA, J.L.                              | Instalaciones de enlace y centros de transformación.  | Donostiarra   |                             |      |      |             |
| VALENTÍN LABARTA, J.L.                              | Instalaciones eléctricas de interior.   | Donostiarra.  |                             |      |      | Básico      |
|   | Código Técnico de la Edificación.   |   |                             |      |      |             |
|   | Reglamento Electrotécnico para Baja Tensión e Instrucciones Técnicas Complementarias (ITC) BT01 a BT51. |   |                             |      |      |             |
|   | Reglamento de Infraestructuras Comunes de Telecomunicación  |   |                             |      |      |             |
|   | Reglamento de Instalaciones Térmicas en Edificios. RITE-2007  |   |                             |      |      |             |
| Hall, F.; Greeno, R.                                | Building Services Handbook  | Routledge   |                             |      |      |             |
| Tymkow, P.; Tassou;S.; Kolokotroni, M.; Jouhara, H. | Building Services Design for Energy Efficient Building  | Routledge   |                             |      |      |             |
| Porges, F.  | HVAC Engineer's Handbook. 11 Ed.  | Routledge   | Oxon, UK.                   |      | 2011 |             |
| Sugarmen, S.C.                                      | HVAC Fundamentals. 2 Ed.  | Lilburn   |                             |      | 2007 |             |
| Grondzik, W.T. & Kwok, A.G.                         | Mechanical and electrical equipment for buildings. 12 Ed.   | Hoboken   | New Jersey                  |      | 2015 |             |
| Chadderton, D.V.                                    | Building services engineering. 6 th edition   | Routledge   |                             |      | 2013 |             |
| David E. Watkins                                    | Heating Services in Buildings   | Wiley-Blackwell   | Chichester, West Sussex, UK |      | 2011 |             |
| ATECYR  | Comentarios al Reglamento de instalaciones térmicas en los edificios (RITE-2007)                        | IDAE  | MADRID                      |      | 2007 | Básico      |
| ATECYR  | Guía técnica de selección de equipos de transporte de fluidos   | IDAE  | MADRID                      |      | 2012 |             |
| ATECYR  | Guía técnica de ahorro y recuperación de energía en instalaciones de climatización                      | IDAE  | MADRID                      |      | 2012 | Básico      |
| ATECYR  | Guía técnica de condiciones climáticas exteriores de proyecto   | IDAE  | MADRID                      |      | 2010 | Básico      |
| ATECYR  | Guía técnica de diseño de centrales de calor eficientes   | IDAE  | MADRID                      |      | 2010 | Básico      |
| ATECYR  | Guía técnica de instalaciones de climatización con equipos autónomos                                    | IDAE  | MADRID                      |      | 2012 | Básico      |
| ATECYR  | Guía técnica para el diseño y cálculo del aislamiento térmico de IDAE conducciones, aparatos y equipos  | IDAE  | MADRID                      |      | 2007 |             |
| ATECYR  | Guía técnica de instalaciones de climatización por agua   | IDAE  | MADRID                      |      | 2012 | Básico      |
| CARMONA FERNÁNDEZ, D.                               | Manual de Instalaciones Eléctricas.   | Editorial @becedario                                    |                             |      |      | Básico      |
| CARRIER AIR CONDITIONING COMPANY                    | Manual de aire acondicionado.   | Marcombo  |                             |      |      | Básico      |
| Carrasco Sánchez, Emilio                            | Instalaciones eléctricas de baja tensión en edificios de viviendas : (adaptado al REBT 2002)            | TEBAR   | MADRID                      |      | 2004 | Básico      |
| DE ANDRÉS Y RODRIGUEZ-POMATTA; AROCA LASTRA, S.     | Climatización I. Calefacción.   | Ediciones Fundación Escuela de la Edificación Ediciones |                             |      |      | Básico      |

|   |  |   |        |        |
|---|--|---|--------|--------|
| DE ANDRÉS Y RODRIGUEZ-POMATTA; AROCA LASTRA, S.   | Climatización II. Acondicionamiento de aire.   | Fundación Escuela de la Edificación. Ediciones del Serbal |        | Básico |
| FUMADÓ ALSINA, J.L.   | Climatización de edificios.  |   |        |        |
| GALDÓN TRILLO, F.; CALVO VILLAMARÍN, T.   | Curso de Instalador de calefacción, climatización y agua caliente sanitaria. Adaptado al RITE 2007 y Código Técnico de la Edificación. | El Instalador   | Madrid | Básico |
| McQUINSTON; PARKER; SPITLER.  | Calefacción, ventilación y aire acondicionado.   | Ed. Limusa-Wiley.   |        |        |
| González Lezcano, R.A.; del Río Campos, J.M.; Aramburu Gaviola, F.; Cesteros García, S. | Instalaciones eléctricas en el diseño de edificios   | Ediciones Asimétricas                                     |        | 2016   |
| IDAE  | Guía técnica de instalaciones de biomasa térmica en edificios  | IDAE  | MADRID | 2009   |
| LLORENS, M.   | Calefacción.   | Ediciones CEAC  |        |        |
| MARTÍN SÁNCHEZ, F.  | Manual de instalaciones de calefacción por agua caliente. Adaptado al C.T.E. y la nuevo RITE   | AMV Ediciones   |        | 2008   |
| MIRANDA, A.L.   | Aire acondicionado.  | Ediciones CEAC  |        |        |