



Teaching Guide

Identifying Data					2021/22
Subject (*)	Physics for Architecture 2	Code	630G02013		
Study programme	Grao en Estudos de Arquitectura				
Descriptors					
Cycle	Period	Year	Type	Credits	
Graduate	1st four-month period	Second	Basic training	6	
Language	Spanish				
Teaching method	Face-to-face				
Prerequisites					
Department	Construcións e Estruturas Arquitectónicas, Cívís e AeronáuticasEnxeñaría Civil				
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Web					
General description	<p>The subject Physics for Architecture 2 provides an introduction to physical phenomena relevant to architectural design and how they are included in current regulations.</p> <p>The behavior of fluids is studied, both moving and at rest, as well as heat transfer focused to building envelopes. It also includes contents of applied acoustics, electricity and, finally, theory of light and color.</p> <p>The subject Physics for Architecture 2 provides an introduction to physical phenomena relevant to architectural design and how they are included in the current mandatory regulations.</p> <p>This is, therefore, a course of physics applied to architecture which includes an approach to hydrostatic contents - that will allow the students, for example, to determine hydrostatic thrusts on walls or slabs-; hydrodynamics - focusing especially on the behavior of fluids inside ducts; concepts of thermodynamics and hygrometry focused on the study of the envelopes of buildings and the thermal conditioning of architectural spaces; acoustics applied to the insulation and conditioning of premises; besides contents about electricity and theory of light and color. Whenever possible, the concepts explained apply to real architectural situations, underscoring the relationship between physics and architecture.</p>				



Contingency plan

1. Modifications to contents

The contents of the subject are not modified

2. Methodologies

Two scenarios are contemplated:

- Scenario 1 (students with face-to-face teaching and students with non-face-to-face teaching, simultaneously): In the event that the capacity of classrooms, due to the conditions demanded by higher authorities, makes it impossible to follow the face-to-face classes by all students, or in the case of one-off confinement of any student, technological means provided by the centre will be implemented to enable that face-to-face classes given by the teaching staff of the subject can be followed in a non-face-to-face mode by the rest of the students.

- Scenario 2 (all students with non-face-to-face teaching): In the case of confinement of a complete group, due to an outbreak, the entire group will be transferred to teaching in a non-face-to-face mode until this situation is resolved and can be returned to the face-to-face mode. In this case, all teaching becomes on-line.

*Teaching methodologies that are maintained

- Scenario 1 (students with face-to-face teaching and students with non-face-to-face teaching, simultaneously): All teaching methodologies are maintained. Students will follow the session on-site and whoever is at home will follow it on-line, through the platform that the UDC enables for this purpose (Teams or similar). In order to make sessions more dynamic, teachers can state a previous reading. Mixed tests at class will be carried out on-site during the interactive sessions and, if this is not possible, they will be carried out on-line.

- Scenario 2 (all students with non-face-to-face teaching): Both the expository and interactive teaching will be carried out on-line. All methodologies are maintained. The expositive sessions will be held on-line, through the platform that the UDC enables for this purpose (Teams or similar). In order to make the on-line sessions more dynamic, teachers can state a previous reading. Interactive sessions will be held on-line (Teams or similar). In this case, they can consist of the explanation of exercises by the teacher, correction and solving doubts on exercises that the teacher has previously provided to students for solving at home, or solving exercises in a collaborative way between teacher and students. Mixed tests at class will be held on-line. Submission of dossiers with exercises will be made via Moodle.

*Teaching methodologies that are modified

Methodologies are not modified

3. Mechanisms for personalized attention to students

Presence-based tutoring will be maintained if possible. In any case, the following personalized attention channels are contemplated:

-Teams, channel: a specific channel for queries will be opened on Teams. This channel will be permanently open and questions will be answered as soon as possible.

-E-mail: students will have the possibility to ask questions also through the teachers' e-mail. However, the Teams channel will preferably be used so that topics can be available to all students.

-Teams, virtual session: in case of questions that present difficulties for their solving in writing, or require direct interaction, a virtual session will be held with the student.

4. Modifications in the evaluation.

-Scenario 1 (students with face-to-face teaching and students with non-face-to-face teaching, simultaneously): The assessment disaggregation indicated in the teaching guide is maintained. Mixed tests held at class will be carried out during the interactive face-to-face sessions. Submission of dossiers with exercises will be made via Moodle. The final objective test will be carried out on-site as long as it is authorized by the competent body. In the event that it is not possible to carry out the objective test on-site, it will be carried out on-line synchronously.

-Scenario 2 (all students with non-face-to-face teaching): The assessment disaggregation indicated in the teaching guide is maintained. Mixed tests at class will be held on-line. Submission of dossiers with exercises will be made via Moodle. The final objective test will be carried out on-site as long as it is authorized by the competent body. In the event that it is not possible to carry out the objective test on-site, it will be carried out on-line synchronously.

* Observations to evaluation

In the event that any student has difficulties with computer equipment or Internet connection to access the software tools provided by the UDC (Teams, Moodle, etc.), for handling both in lessons and in a hypothetical on-line test, they must communicate this circumstance to the teaching staff as soon as possible, in order to find a solution.

5. Modifications to the bibliography or webgraphy

The bibliography indicated in the teaching guide is not modified. If new basic documentation is considered during the period of confinement, it will be made available to students through Moodle.



Study programme competences / results	
Code	Study programme competences / results
A8	"Knowledge of the principles of thermodynamics, acoustics and optics adapted and applied to architecture and urbanism ";
A9	"Knowledge of of the principles of fluid mechanics, hydraulics, electricity and electromagnetism adapted and applied to architecture and urbanism ";
A63	Development, presentation and public review before a university jury of an original academic work individually elaborated and linked to any of the subjects previously studied
B1	Students have demonstrated knowledge and understanding in a field of study that is based on the general secondary education, and is usually at a level which, although it is supported by advanced textbooks, includes some aspects that imply knowledge of the forefront of their field of study
B2	Students can apply their knowledge to their work or vocation in a professional way and have competences that can be displayed by means of elaborating and sustaining arguments and solving problems in their field of study
B3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgements that include reflection on relevant social, scientific or ethical issues
B4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist public
B5	Students have developed those learning skills necessary to undertake further studies with a high level of autonomy
B6	Knowing the history and theories of architecture and the arts, technologies and human sciences related to architecture
B10	Knowing the physical problems, various technologies and function of buildings so as to provide them with internal conditions of comfort and protection against the climate factors in the context of sustainable development
B11	"Knowing the industries, organizations, regulations and procedures involved in translating design concepts into buildings and integrating plans into planning ";
B12	Understanding the relationship between people and buildings and between these and their environment, and the need to relate buildings and the spaces between them according to the needs and human scale
C1	Adequate oral and written expression in the official languages.
C3	Using ICT in working contexts and lifelong learning.
C4	Exercising an open, educated, critical, committed, democratic and caring citizenship, being able to analyse facts, diagnose problems, formulate and implement solutions based on knowledge and solutions for the common good
C5	Understanding the importance of entrepreneurial culture and the useful means for enterprising people.
C6	Critically evaluate the knowledge, technology and information available to solve the problems they must face
C7	Assuming as professionals and citizens the importance of learning throughout life
C8	Valuing the importance of research, innovation and technological development for the socioeconomic and cultural progress of society.

Learning outcomes			
Learning outcomes	Study programme competences / results		
FLUID MECHANICS AND HYDRAULICS	A8	B1	C1
	A9	B2	C3
	A63	B3	C5
		B4	C6
		B5	C7
		B6	C8
		B10	



HEAT TRANSFER IN REAL WALLS	A8 A9 A63	B1 B2 B3 B4 B5 B6 B10 B11 B12	C1 C3 C4 C6 C7 C8
ACOUSTICS	A8 A9 A63	B1 B2 B3 B4 B5 B6 B10	C1 C3 C5 C6 C7 C8
ELECTRICITY	A8 A9 A63	B1 B2 B3 B4 B5 B6 B10	C1 C3 C5 C6 C7 C8
THEORY OF LIGHT AND COLOUR	A8 A9 A63	B1 B2 B3 B4 B5 B6 B10	C1 C3 C5 C6 C7 C8

Contents	
Topic	Sub-topic



FLUID MECHANICS AND HYDRAULICS	INTRODUCTION HISTORY PROPERTIES OF FLUIDS HYDROSTATICS PRESSURE AT A POINT BASIC PRINCIPLES FUNDAMENTAL EQUATION SUBMERGED SURFACE PRESSURES HYDROSTATIC THRUST PRESSURE CENTER PRISMA PRESSURE FUNDAMENTALS OF FLUID FLOW CLASSIFICATION OF FLOWS LINES, POWER WIRES AND TUBES FLOW. DIMENSIONAL EQUATION. UNITS ENERGY IN A MOVING FLUID BERNOULLI THEOREM IDEAL FLUID REAL FLUID HYDRAULIC POWER FLUID FLOW MEASUREMENT FLUID FLOW IN PIPES INTRODUCTION. LAMINAR AND TURBULENT FLOWS DISTRIBUTION OF SPEED. BOUNDARY LAYER ADIMENSIONASL NUMBERS. REYNOLDS NUMBER SURFACE RESISTANCE. PRIMARY LOAD LOSSES GENERAL EQUATION MOODY CHART HIGH LOAD LOSSES BRANCHED, SERIAL AND PARALLEL PIPING SYSTEMS MESHES OPEN CHANNEL FLOW MANNING AND CHÉZY FORMULA FORCES DEVELOPED BY FLUID MOTION PRINCIPLES OF MOMENTUM - MOMENTUM FORCES ON ELBOWS WATER HAMMER
HEAT TRANSFER IN REAL WALLS	COMBINED ACTION OF THREE MECHANISMS OF HEAT TRANSFER WINTER CONDITIONS HEAT TRANSFER THROUGH OPAQUE WALLS TEMPERATURE DISTRIBUTION IN THE ENCLOSURE HEAT TRANSFER ARISING FROM INFILTRATIONS AND ROOM VENTILATION SUMMER CONDITIONS HEAT TRANSFER THROUGH OPAQUE WALLS THERMAL INERTIA OF THE ENCLOSURE HEAT TRANSFER THROUGH SEMITRANSSPARENT WALLS



ACOUSTICS	<p>SOUND. FUNDAMENTAL CONCEPTS AUDITORY PHYSIOLOGY PHYSICAL ASPECTS OF SOUND SOUND INSULATION SOUND DAMPING ACOUSTIC CONDITIONING SOUND ENERGY ABSORBING SYSTEMS SOUND ENERGY ABSORBING MATERIALS ARCHITECTURAL ACOUSTICS CTE - DB-HR</p>
ELECTRICITY	<p>INTRODUCTION ELECTRIC CHARGE COULOMB LAW CONCEPT OF ELECTRIC FIELD. LINES OF FORCE ELECTRIC POTENTIAL. ELECTRIC POTENTIAL DIFFERENCE ELECTRICITY OHM'S LAW RESISTIVITY ENERGY IN ELECTRICAL CIRCUITS. ELECTRIC POWER CURRENT. AC POWER. C. A. PHASE. C. A. PHASE DISTRIBUTION NETWORKS FEATURES. TYPES LOW VOLTAGE ELECTRICAL INSTALLATIONS LOW VOLTAGE SUPPLY TO BUILDING PROTECTION SYSTEMS</p>
THEORY OF LIGHT AND COLOUR	<p>INTRODUCTION. HISTORY ELECTROMAGNETIC WAVES. FEATURES. CLASSIFICATION SPREAD OF LIGHT. FRESNEL-HUYGENS PRINCIPLE. REFLECTION AND REFRACTION PHOTOMETRIC QUANTITIES PURKINJE EFFECT LIGHT FIGURES FLOW. INTENSITY. ILLUMINANCE. LUMINANCE REFLECTANCE, ABSOTANCE AND TRANSMISSION. LIGHT AND VISION THE HUMAN EYE VISUAL PERFORMANCE FACTORS GLARE COLOR TEMPERATURE OF LIGHT THEORY OF COLOUR</p>

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Introductory activities	A8 A9 A63 B1 B2 B3 B4 B5 B6 B10 C1 C3 C5 C6 C7 C8	2	0	2



Guest lecture / keynote speech	A8 A9 B1 B2 B3 B4 B5 B6 B10 B11 C4 C8	23	23	46
Problem solving	A8 A9 B1 B2 B3 B4 B5 B6 B10 B11 B12 C1 C3 C4 C7 C8	23	23	46
Diagramming	A8 A9 B1 B2 B3 B4 B10	1	0	1
Glossary	A8 A9 B1 B3 B6 B10 B11 C1	0	1	1
Workbook	A8 A9 B1 B2 B3 B4 B5 B6 B10 B11 B12 C1 C3 C7 C8	0	28	28
Supervised projects	A8 A9 B1 B2 B3 B4 B5 B6 B10 B11 B12 C1 C3 C4	1	15	16
Mixed objective/subjective test	A8 A9 B1 B2 B3 B4 B5 B6 B10 B11 C8	4	0	4
Multiple-choice questions	A8 A9 B1 B2 B3 B4 B5 B6 B10 B11 C8	1	0	1
Objective test	A8 A9 B1 B2 B3 B4 B5 B6 B10 B11 B12 C1 C3 C8	4	0	4
Personalized attention		1	0	1

(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
Methodologies	Description
Introductory activities	Presentation on the subject, explaining its operating issues and objectives.
Guest lecture / keynote speech	Lessons in which the teacher will present theoretical or practical contents of the subject on the board or through audiovisual resources, and/or solves doubts about readings that students have carried out.
Problem solving	A series of case studies will be presented at class and solved, partially or totally, by the students, with help and advice from the teacher.
Diagramming	Scheme-based brief introductions to each topic aim at relating the contents within the knowledge map of the degree.
Glossary	The students prepare a summary sheet with definitions, formulation and physical units related to each of the topics of the subject.
Workbook	The students select and analyze exercises and/or theory about the subject from the basic and complementary bibliography, or from the materials provided by teachers.
Supervised projects	Students will turn in problems on each of the topics of the subject. They must be solved individually and personally, manuscript in paper format A4. They will allow, along with meeting attendance requirements, to have access to additional marks for the course.
Mixed objective/subjective test	Individual solving, at class, theoretical or practical exercises proposed by the teacher throughout the course.
Multiple-choice questions	A multiple choice test will assess the level of learning of theoretical and practical aspects of the subject.
Objective test	Numerical and graphical problems on the contents of the subject and the support bibliography will be presented. It will assess the level of learning of practical aspects of the subject.



Personalized attention

Methodologies	Description
Supervised projects Problem solving	<p>Teachers will support, solve and explain personally any doubts that may arise at class, when students are proposed to completely or partially solve problems.</p> <p>Personalized attention to the supervised works will be carried out according to the tutoring schedule of the teachers. In this sense, the tutoring schedules will be displayed on the platform provided for this purpose by the UDC.</p> <p>Continued study of the subject is considered fundamental. Therefore, it is especially advisable to attend tutorials, in order to clarify any doubts that may arise during the development of the course.</p>

Assessment

Methodologies	Competencies / Results	Description	Qualification
Supervised projects	A8 A9 B1 B2 B3 B4 B5 B6 B10 B11 B12 C1 C3 C4	It is required to individually and personally pose and solve exercises on the items described in the content section of the subject. The teacher will establish the time and form along the course, as well as its deadline for handing in.	5
Multiple-choice questions	A8 A9 B1 B2 B3 B4 B5 B6 B10 B11 C8	Accuracy in answering ten questions about theoretical and practical aspects will be assessed. Each of them will have four options, at least one being correct. The conditions for wrong answers will be set in the formulation of the exercise	20
Objective test	A8 A9 B1 B2 B3 B4 B5 B6 B10 B11 B12 C1 C3 C8	<p>Problems or case studies based on the syllabus and bibliography will arise, and students will give numerical answer to each of them. They may even have to represent the results graphically.</p> <p>Each exercise will be answered and will qualify in a separate DIN A3 sheet. Each exercise will be handed in independently, written in indelible ink and folded in A4 size. The student name and group must be written in every paper, including the exam sheet, in order to be assessed.</p> <p>The result will be given in a clearly visible way, indicating the numeric value with precision and appropriate units. Invalid parts must be clearly cancelled.</p>	60
Mixed objective/subjective test	A8 A9 B1 B2 B3 B4 B5 B6 B10 B11 C8	It will be necessary to pass the individualized control tests raised by the teacher throughout the academic year. These will be held without prior notice. These control tests can be both theoretical and practical.	15

Assessment comments



EVALUATION CRITERIA

For a favorable assessment, the student must obtain five point out of ten, according to this disaggregation (equal for both 1st and 2nd opportunities):

- Multiple-choice questions: 2 points.
- Objective practical test: 6 points.
- Course mark: supervised projects 0,5 points; objective/subjective test 1,5 points.

a)First opportunity: at the end of the four-month teaching period, students will have access to assessment as long as they comply with the following conditions:

- Having attended to at least 80% of the lessons of the subject.
- Having scored at least 1 point (out of 2) in the course mark (supervised projects + objective/subjective test).

b)Second opportunity: open to all students who have signed up for the subject, regardless of their percentage of attendance and fulfilment of course mark requirements. The disaggregation will remain as indicated above.

During the development of the theoretical questionnaire no materials of any kind will be allowed beyond pens, while for the realization of the practical part, forms, calculator and drawing materials can be used. The exam is individual. Non-compliance with this requirement will result in expulsion and implementing regulations. Mobile phones, smart watches or any other devices for storage, photography, sharing or accessing information are strictly prohibited during the examination. All these devices must remain switched off and off the table. Taking pictures of the examen, during the examination, will lead to expulsión.

Marks will be announced within the legally established time limits. The day and time for the revision will be indicated on the list of marks. This date will meet the requirements of the Academic Regulation for Assessment, Qualifications and Claims.

CORRECTION CRITERIA

The correction criteria are adapted to those derived from professional reality. As a general rule, misconceptions will be valued according to their severity, and may nullify the exercise. The commission of a numerical error is also relevant, given that the professional practice seeks concrete results. In this regard, it is pointed out that a mistaken sign means an error of 200%.

CONDITIONS FOR PART-TIME MODALITY STUDENTS

Students enrolled in the part-time modality (having proved this upon presentation of the enrollment receipt or the resolution of acceptance of this condition from the study centre) will have access to both opportunities, being exempted from the minimum attendance to lessons and the minimum of the course mark. In these cases, the exam will be the only evaluation element, scoring from 0 to 10 points, being necessary to obtain at least 5 points to pass the subject.

IMPORTANT NOTE IN RELATION TO THE INCIDENCE OF COVID-19 Both the teaching and the evaluation of the subject will be done in a presence-based modality. In the event that the spatial limitations motivated by the prevention and health measures, or other conditioning factors related to the pandemic, may make it impossible to conduct any or all of the teaching and/or evaluation methodologies on-site, these will be carried out according to what is established in the contingency plan.



<p>Basic</p>	<ul style="list-style-type: none"> - López César, I.; Freire Tellado, M.; Muñoz Vidal, M. (2020). Fundamentos de Física para Arquitectos. Universidade da Coruña. Reprografía Noroeste - Freire Tellado, M.; Muñoz Vidal, M (2007). Introducción a las condiciones Térmicas en Edificación . Departamento de Tecnología de la Construcción . UDC - Mataix, Claudio (1982). Mecánica de fluidos y máquinas hidráulicas (2ª edición). México: Alfaomega - Varios (2008). Fundamentos Físicos de la Arquitectura I. Departamento de Tecnología de la Construcción. ETSAC - Guerrero, A (). Instalaciones eléctricas en las edificaciones. Editorial McGraw-Hill - Ramírez Vázquez, J (). Luminotecnia. Editorial Ceac - Arau Puchades, Higiní (1999). ABC de la acústica arquitectónica. Barcelona: Planeta - Roca Vila, M (1980). Introducción a la mecánica de los fluidos. México: Limusa - Beranek Leo (1986). Acoustics. McGraw-Hill: New York - Varios (2009). Código Técnico de la Edificación. Documento básico HR. Protección frente al ruido.. Ministerio de Fomento, Gobierno de España. - Varios (2009). Código Técnico de la Edificación. Documento básico HE. Ahorro de energía. Ministerio de Vivienda, Gobierno de España.
<p>Complementary</p>	<ul style="list-style-type: none"> - Augé, R. (). Curso de electricidad general. Editorial Paraninfo - Agüera Soriano (). Mecánica de fluidos. Editorial Ciencia y Distribución - Giles, R. V, Evett, J., Liu, C. (1995). Mecánica de los fluidos e hidráulica. Editorial McGraw-Hill Interamericana. Mexico - López Hernández, E; Muñoz Vidal, M (1994). Introducción a las instalaciones de edificación. Departamento de Tecnología de la Construcción. A Coruña - Bueche, F. J (). Física para estudiantes de ciencias e ingeniería. Editorial McGraw-Hill. - Manuel Margarida (). Aislamiento térmico. Editorial Etasa. - Llinares, J.; Lloppis Regna (). Fundamentos de acústica. Universidad Politécnica de Valencia - Guillón, López Rodríguez (1999). Problemas de física (volumen 2). Madrid: Editorial Limusa - Avilés López, R., Perera Martín, R. (2017). Manual de acústica ambiental y arquitectónica. Madrid: Paraninfo. - Carrión Isbert, A. (1998). Diseño acústico de espacios arquitectónicos. Barcelona: Edicions UPC. - Varios (2009). Catálogo de elementos constructivos del CTE.. Redacción: Instituto Eduardo Torroja. Ministerio de vivienda, Gobierno de España. - Colina Tejeda, C., Moreno Arranz, A. (1999). Acústica de la edificación.. Madrid: Fundación Escuela de la Edificación. - López César, I.; Freire Tellado, M.; Muñoz Vidal, M. (2020). Fundamentos de Física para Arquitectos.. Universidade da Coruña. Reprografía Noroeste - Recuero López, M (1999). Ingeniería acústica.. Madrid: Paraninfo - Zwicker, C. Kosten, C.W. (). Sound absorbing materials. Amsterdam: Elsevier Publishing Company. - Varios (2007). Guía técnica para la rehabilitación de la envolvente térmica de los edificios. Soluciones de aislamiento con vidrios y cerramientos.. Instituto para la diversificación y ahorro de la energía. Ministerio de Industria. Gobierno de España

Recommendations

Subjects that it is recommended to have taken before

Physics 1/630G01008

Subjects that are recommended to be taken simultaneously

Projects 3/630G01011

Architectural Analysis 1/630G01012

Geometry of Architectural Form/630G01014

Subjects that continue the syllabus

Structures 1/630G01019

Other comments



For properly following the subject prior mastery of the following topics is required to the students: - Logical Reasoning. - Unit systems. - Geometry and Trigonometry. - Derivation and integration. - Solving systems of equations. - Basic knowledge of building materials.

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.