

Teaching Guide						
Identifying Data					2019/20	
Subject (*)	Physics for Architecture 2 Code			630G02013		
Study programme	Grao en Estudos de Arquitectura	I				
		Descr	riptors			
Cycle	Period	Ye	ar	Туре	Credits	
Graduate	1st four-month period	Sec	ond	Basic training	6	
Language	SpanishEnglish					
Teaching method	Face-to-face					
Prerequisites						
Department	Construcións e Estruturas Arquit	ectónicas, Civís	s e AeronáuticasE	nxeñaría Civil		
Coordinador	López César, Isaac		E-mail	isaac.lopez@udc.	.es	
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Web						
General description	The subject Physics for Architect	ture 2 provides a	an introduction to	physical phenomena rele	evant to architectural design and	
	how they are included in current	regulations.				
	The behavior of fluids is studied,	both moving an	nd at rest, as well	as heat transfer focused	to building envelopes. It also	
	includes contents of applied acou	ustics, electricity	y and, finally, theo	ry of light and color.		
	The subject Physics for Architect	ture 2 provides a	an introduction to	physical phenomena rele	evant to architectural design and	
	how they are included in the curr	ent mandatory	regulations.			
	This is, therefore, a course of phy	ysics applied to	architecture whic	h includes an approach to	o 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 condition	oning of archite	ctural spaces; acc	oustics applied to the insu	lation 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.					

	Study programme competences
Code	Study programme competences
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	/ progra	imme	
	CO	npeten	ces	
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	B1	C1	
	A9	B2	C3	
	A63	B3	C4	
		B4	C6	
		B5	C7	
		B6	C8	
		B10		
		B11		
		B12		
ACOUSTICS	A8	B1	C1	
	A9	B2	C3	
	A63	B3	C5	
		B4	C6	
		B5	C7	
		B6	C8	
		B10		
ELECTRICITY	A8	B1	C1	
	A9	B2	C3	
	A63	B3	C5	
		B4	C6	
		B5	C7	
		B6	C8	
		B10		



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DRY OF LIGHT AND COLOUR	A8	B1	C1	
	A9	B2	C3	
	A63	B3	C5	
		B4	C6	
		B5	C7	
		B6	C8	
		B10		

	Contents
Торіс	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 SEMITRANSPARENT WALLS
ACOUSTICS	SOUND. FUNDAMENTAL CONCEPTS
	AUDITORY PHYSIOLOGY
	PHYSICAL ASPECTS OF SOUND
	SOUND INSULATION
	SOUND DAMPING
	ACOUSTIC CONDITIONING
	SOUND ENERGY ABSORBING SYSTEMS
	SOUND ENERGY ABSORBING MATERIALS
	CTE - DB-HR
	ELECTRIC CHARGE
	RESISTIVITY
	CURRENT
	FEATURES TYPES
	PROTECTION SYSTEMS
	ELECTROMAGNETIC WAVES FEATURES CLASSIFICATION
	THEORY OF COLOUR



Planning						
Methodologies / tests	Competencies	Ordinary class	Student?s personal	Total hours		
		hours	work hours			
Introductory activities	A8 A9 A63 B1 B2 B3	2	0	2		
	B4 B5 B6 B10 C1 C3					
	C5 C6 C7 C8					
Guest lecture / keynote speech	A8 A9 B1 B2 B3 B4	23	23	46		
	B5 B6 B10 B11 C4					
	C8					
Problem solving	A8 A9 B1 B2 B3 B4	23	23	46		
	B5 B6 B10 B11 B12					
	C1 C3 C4 C7 C8					
Diagramming	A8 A9 B1 B2 B3 B4	1	0	1		
	B10					
Glossary	A8 A9 B1 B3 B6 B10	0	1	1		
	B11 C1					
Workbook	A8 A9 B1 B2 B3 B4	0	28	28		
	B5 B6 B10 B11 B12					
	C1 C3 C7 C8					
Supervised projects	A8 A9 B1 B2 B3 B4	1	15	16		
	B5 B6 B10 B11 B12					
	C1 C3 C4					
Mixed objective/subjective test	A8 A9 B1 B2 B3 B4	4	0	4		
	B5 B6 B10 B11 C8					
Multiple-choice questions	A8 A9 B1 B2 B3 B4	1	0	1		
	B5 B6 B10 B11 C8					
Objective test	A8 A9 B1 B2 B3 B4	4	0	4		
	B5 B6 B10 B11 B12					
	C1 C3 C8					
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 /	Lessons in which the teacher will present theoretical or practical contents of the subject on the board or through audiovisual
keynote speech	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	Individual solving, at class, theoretical or practical exercises proposed by the teacher throughout the course.
objective/subjective	
test	
Multiple-choice	A multiple choice test will assess the level of learning of theoretical and practical aspects of the subject.
questions	
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	Teachers will support, solve and explain personally any doubts that may arise at class, when students are proposed to			
Problem solving	completely or partially solve problems.			
	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.			
	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.			

Assessment				
Methodologies	Competencies	Description	Qualification	
Supervised projects	A8 A9 B1 B2 B3 B4	It is required to individually and personally pose and solve exercises on the items	5	
	B5 B6 B10 B11 B12	described in the content section of the subject. The teacher will establish the time and		
	C1 C3 C4	form along the course, as well as its deadline for handing in.		
Multiple-choice	A8 A9 B1 B2 B3 B4	Accuracy in answering ten questions about theoretical and practical aspects will be	20	
questions	B5 B6 B10 B11 C8	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		
Objective test	A8 A9 B1 B2 B3 B4	Three problems or case studies based on the syllabus and bibliography will arise, and	60	
	B5 B6 B10 B11 B12	students will give numerical answer to each of them. They may even have to		
	C1 C3 C8	represent the results graphically.		
		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.		
		The result will be given in a clearly visible way, indicating the numeric value with		
		precision and appropiate units. Invalid parts must be clearly cancelled.		
Mixed	A8 A9 B1 B2 B3 B4	It will be necessary to pass the individualized control tests raised by the teacher	15	
objective/subjective	B5 B6 B10 B11 C8	throughout the academic year. These will be held without prior notice. These control		
test		tests can be both theoretical and practical.		

Assessment comments



EVALUATION CRITERIA

For a favorable assessment, the student must obtain five point out of ten, according to this dissagregation (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 condicions:

- 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 dissagregation 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.

Sources of information



Basic	- 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
	- Freire Tellado, M.; Muñoz Vidal, M (2007). Introducción a las condiciones Térmicas en Edificación . Departamento
	de Tecnología de la Construcción . UDC
	- Guerrero, A (). Instalaciones eléctricas en las edificaciones. Editorial McGraw-Hill
	- Ramírez Vázquez, J (). Luminotecnia. Editorial Ceac
	- Arau Puchades, Higini (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.
Complementary	- Auge, R. (). Curso de electricidad general. Editorial Paraninto
	- Aguera Soriano (). Mecanica de fluidos. Editorial Ciencia y Distribución
	- Giles, R. V, Evett, J., Liu, C. (1995). Mecanica de los fluidos e hidraulica. Editorial McGraw-Hill Interamericana.
	- 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 (). Aislameinto 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.
	- Recuero López, M (1999). Ingeniería acústica Madrid: Paraninfo
	- Zwikker, 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
	Españ

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 studens: - 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.