



Teaching Guide

Teaching Guide				
Identifying Data			2021/22	
Subject (*)	Foundations	Code	630G02043	
Study programme	Grao en Estudos de Arquitectura			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Fifth	Obligatory	6
Language	English			
Teaching method	Face-to-face			
Prerequisites				
Department	Construcións e Estruturas Arquitectónicas, Cívís e Aeronáuticas			
Coordinador	Freire Tellado, Manuel Jose	E-mail	manuel.freire.tellado@udc.es	
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Web	fv.udc.es			
General description	After completing the course on foundations, the student will be able to effectively identify, confront and assess the usual problems that the usual foundation and containment structures may present within the context of the new architectural work. In order to develop these capacities, the necessary knowledge regarding the mechanics of the soil and the basic techniques of projecting and calculating the foundation and containment elements will be provided, complementing this knowledge with the existing bibliography and regulations. These contents will be exposed in the theory classes. To guarantee that the student is able to apply this knowledge adequately, a series of practical classes are proposed that will deal with the project, design and calculation of foundation elements, complemented by carrying out specific work on the subject. These works will be related to the professional activity of the architect within the specific content of this subject.			



Contingency plan	<p>A scenario is proposed in which, faced with a possible temporary confinement, no type of face-to-face teaching is feasible. In this case, the expected changes are as follows:</p> <p>1. Modifications to the contents No changes are made</p> <p>2. Methodologies * Teaching methodologies that are maintained None * Teaching methodologies that are modified Master session, problem solving, workshop, diagrams, mixed test. The impossibility of continuing to use both methodologies in face-to-face format forces us to adopt alternative strategies that facilitate learning regardless of possible contingencies related to the equipment and connection of the students. For this reason, it is decided to provide the necessary documentation through the Moodle platform to continue advancing in the training program, and the rest of the tasks are carried out with the help of the Teams platform included in Office365. For this, it is contemplated the realization of 1 weekly session of Teams in a large group for the presentation of the theoretical contents, another weekly session for the workshop teaching and as many as there are subgroups for teaching in interactive classes. All these sessions will be held in the time slot assigned to the subject in the degree calendar.</p> <p>3. Mechanisms for personalized attention to students Moodle, virtual forum, email The forum remains open throughout the school period, with teachers responding to possible queries both during the virtual sessions and during the official tutoring hours. Teams, virtual meetings and channels. The communication channels (general and by groups) are kept open so that the student can raise questions. Email. It is the most frequent way of communicating the doubts posed to the student. It is attended as a minimum according to the tutoring schedules established by the teacher.</p> <p>4. Changes in the evaluation Mixed tests. Rating weight 70% They will be developed online using Teams, Moodle, Forms or any other institutional tool that facilitates the electronic contribution of answers, images or other types of documents that allow assessing the level of competence acquired by the student in the matter. Prior to the performance of the test, the specific conditions of performance will be provided. Practices and Workshop. Rating weight 30%. The general practice that will be developed in the workshop and the practices carried out during the course are included in this section.</p> <p>* Evaluation observations: The indicated evaluation criteria are maintained. Students who for justified reasons related to the computer or connection equipment, duly accredited, could not take the exams corresponding to the mixed tests online, will have the right to take said mixed tests orally, being an essential requirement to request it by email the same day of the exam, after which they will be summoned for its completion.</p> <p>5. Modifications of the bibliography or webgraphy No changes are made.</p>
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Study programme competences / results	
Code	Study programme competences / results
A15	Ability to conceive, calculate, design, integrate in buildings and urban units and execute foundation solutions (T)



Learning outcomes			
Learning outcomes	Study programme competences / results		
Domain of CTE-SE-C and EHE-08	A15		
Foundation and / or containment structure project	A15		
Direction of Foundations and Containments works	A15		
Maintenance and conservation of foundations	A15		
Foundations and Containment Execution Project	A15		
Knowledge of the soil as a support for the building	A15		

Contents	
Topic	Sub-topic
1. INTRODUCTION	1.1 Basic Concepts 1.2 Foundations Structures and Retaining Structures 1.3 Regulations: CTE-SE-C (EC-7)
2. LIMIT STATE	2.1 Limit States Concept: ULS and SLS 2.2 Design analysis process. Partial design factors in foundations and retaining structures analysis 2.3 Design process in CTE-SE-C and EC-7
3. SOIL MECHANICS	3.1 Soil Classification 3.2 Soil Physical Properties: density, particle size, consistency, permeability. 3.3 Water and Soil: wáter table, fluid, siphoning, Terzagui's Law 3.4 Soil Consolidation 3.5 Soil Compresibility. Oedometer test. Oedometer Graphics. 3.6 Shear Strength. Direct Shear Test and Triaxial Compression Test. Soil Stress States
4. SOIL BEARING CAPACITY	4.1 Stress and Settlement. 4.2 Bearing Pressure. Efective Surface 4.3 Determination of Ultimate Beareing Capacity 4.4 Simplified Method 4.5 Foundations on rocks 4.6 Soil Elastic Response: Ballast Modulus 4.7 Geotechnical Stress and Structural Stress
5. GEOTECHNICAL REPORT	5.1 Basic Concepts 5.2 Scope and Contents 5.3 Types of Tests. Borehole, Soil Soundings, Penetration Test 5.4 Laboratory Analysis 5.5 Evaluation 5.6 Reference Tables
6. SPREAD FOUNDATIONS: FOOTINGS (PADS)	6.1 Introduction. Types of Spread Foundations 6.2 Continuous footing 6.3 Isolated footing 6.4 Strap footing. Strap beam 6.5 Particular Solutions 6.6 Constructive Details



7. SPREAD FOUNDATIONS: FLOATING FOUNDATIONS	7.1 Introduction. Types. Peculiarities 7.2 Combined footing 7.3 Beam Foundations 7.4 Grillage Foundations 7.5 Mat or Raft foundations 7.6 Constructive Details
8. TRENCH FILL FOUNDATIONS	8.1 Basic Concepts 8.2 Trench fill foundations 8.3 Constructive Details
9. PILE FOUNDATIONS	9.1 Introduction. Types 9.2 Piles 9.3 Micropiles 9.4 Pile Cap 9.5 Tie Beam 9.6 Constructive Details
10. LATERAL PRESSURE OF SOIL	10.1 Types: Active Pressure, Passive Pressure. Rest Earth Pressure 10.2 Coulomb's Formula. CTE considerations 10.3 Propped Walls. 10.4 Water Table and Pressure. 10.5 Loads
11. RETAINING WALL DESIGN	11.1 Introduction. Types 11.2 Retaining Walls. Gravity Walls. Cantilevered Tilt-up Walls. Countertop Retaining Walls. Shelves Retaining Walls. 11.3 Basement Walls 11.4 Anchored Retaining Walls 11.5 Slurry or Diaphragm Walls 11.6 Pile Retaining Walls 11.7 Other Solutions: muros ecológicos y tablestacas.
12. EXCAVATION TECHNIQUES	12.1 Soil Interventions 12.2 Techniques in compact soils 12.3 Water and excavation 12.4 Slope Design 12.5 Soil Slope Stability 12.6 Rock Slope Stability
13. SOIL IMPROVEMENT TECHNIQUES	13.1 Soil Improvement Techniques: Vibro Replacement, Vibro Compaction, Jet-Grouting, Deep Mixed 13.2 Soil Replacement

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student's personal work hours	Total hours
Introductory activities	A15	0	1	1
Guest lecture / keynote speech	A15	30	0	30
Problem solving	A15	18	9	27
Case study	A15	0	3	3
Workbook	A15	0	6	6
Objective test	A15	4	36	40
Supervised projects	A15	2	24	26
Workshop	A15	6	6	12
Events academic / information	A15	0	2	2



Personalized attention		3	0	3
(*)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	Based on the contents of the teaching guide and the presentation of the subject, the student reviews his previous knowledge and recovers the previous teaching material related to the subject.
Guest lecture / keynote speech	Set of classes and conferences in which the expository work of the rapporteur (teacher and / or lecturer) is essential, work that is carried out with the support of the T.I.C. They consist of the development of the various topics on the agenda. The student must get used to handling the recommended bibliography of the subject, which can be found in the ETSA library (and partially also on the internet) with the support of the outlines of the classes available in the virtual faculty, as well as in reprography. The continuous monitoring of the theoretical classes is a requirement of the subject that is considered fulfilled with the attendance at least 80% of the classes that are developed in person.
Problem solving	The student will solve exercises oriented towards future professional practice under the tutelage of the teacher. We will insist on presenting the result in a way that is clearly visible, indicating the numerical value with the corresponding precision and units. The most common mistakes that are usually made will be explained, evaluating them according to their severity, both conceptual and numerical. Later, similar exercises will be proposed for their development by the students. The delivery of 80% of the properly resolved practices proposed is required.
Case study	The student is confronted with a specific real case, with an important structural content, which describes a real situation in professional life. The student must be able to analyze a series of facts, referring to the intervention on foundation structures to reach a reasoned decision through a process of discussion and critical reasoning, propose an action and confront it with the one carried out in reality.
Workbook	Acquisition of a general conceptual framework by reading texts about soil mechanics and foundations, as well as deepening on the various topics of the program and others that may be specifically interesting, due to the particular conditions of the work to be carried out.
Objective test	The student must pass two eminently practical tests that may include theoretical content on the different aspects of the subject presented in class.
Supervised projects	Throughout the course, the student will have to carry out work that involves the design of the structures and foundations of a building, as well as the dimensioning and elaboration of the appropriate plans of the foundations made at a professional level. This work is part of the development of an architectural project, progressively incorporating the different themes that are developed in theory. Those students who are not linked to the workshop will design a concrete porticoed building in the first three weeks of the course and will progressively develop all the aspects that will allow the design and calculation of the foundation, which will be organized in partial deliveries that will be recast in a final delivery. Monitoring is required throughout the course and its delivery on the date specified for it, not admitting delivery at the second opportunity.
Workshop	The student must project the structure and foundation of the projected building in a workshop regime, size the foundation and represent it adequately at a professional level. Starting with the building designed in the workshop, the methodology set forth in supervised work will be followed. The workshop, in accordance with the provisions of the current Curriculum, is subject to a process of continuous evaluation since it is also an interdisciplinary task. The revisions and deliveries that are made throughout the course are those that allow to guarantee the authorship of the work and to contrast its evolution. For this reason, follow-up is required throughout the course and its delivery on the date specified for it, not admitting its delivery at the second opportunity.
Events academic / information	Activities carried out by the student that involve attendance and participation in scientific and informative events (congresses, conferences, symposia, courses, seminars, conferences, exhibitions, visits to works, etc.) with the aim of deepening the knowledge of topics related to The matter. These activities provide the student with current knowledge and experiences that incorporate the latest developments in the field of study.



Personalized attention

Methodologies	Description
Supervised projects Problem solving Workshop	<p>During the practical classes, in which the resolution of problems related to the competences of the subject will be faced, under the supervision of the teacher. This contact will allow personalized attention to the student's doubts.</p> <p>The student will demonstrate the effective monitoring of the subject by attending tutorials in which the evolution of the development of the proposed works will be controlled, doubts will be clarified in carrying out the proposed exercises, and the contents will be related to the basic bibliography and / or complementary.</p> <p>Attendance and activity carried out will be controlled</p>

Assessment

Methodologies	Competencies / Results	Description	Qualification
Supervised projects	A15	Evaluation of the developed project	30
Objective test	A15	Test Results	70
Others			

Assessment comments

Assessment, as a system for collecting information aimed at making value judgments (and where appropriate, of merit) about the learning process, requires continuous development with constant student involvement. With this premise, attendance and participation are understood as fundamental, so that an unjustified and repetitive absence has an adverse effect on the grade obtained per course, in a similar proportion to a lack of participation or a negative attitude. In addition, the correction criteria include not only the accuracy of the results, but also the clarity of the presentation, the structuring of the analysis carried out, the use of units, the correct application of the normative criteria, and the terminology used.

The continuous evaluation system is configured with two objective tests, which will be carried out during the course, and a supervised work that will be developed throughout the semester and whose follow-up will require partial deliveries. The mixed tests represent 70% of the global qualification and the remaining 30% corresponds to the qualification of the supervised work, which includes the workshop work. To be able to take the intermediate objective tests, it will be a requirement to have an attendance of at least 80% to the theory classes in physical face-to-face mode and to the subject practices, as well as 80% of the weekly practices properly delivered.

Passing the subject requires obtaining a minimum global grade, considering both the mixed tests and the supervised work, of 5 out of 10.

Students who have not passed the subject per course will reexamine the pending parts on both occasions of the same course. In both cases, the note of the supervised work will be kept.

For the second opportunity, the possibility of improving the supervised works presented is not contemplated due to the impossibility of guaranteeing the authorship of the student. Therefore, the student who has not submitted this work at the time will not be able to compute this section.

For the advanced call, the note of the supervised work will also be kept, but in this case the students can choose to modify it by attending the workshop classes of the subject. It will be delivered one week before the exam period for this opportunity.

Sources of information



<p>Basic</p>	<ul style="list-style-type: none"> - AA.VV. (2006). Código Técnico de la Edificación. Documento Básico de Seguridad Estructural: Cimientos CTE SE-C. Ministerio de Vivienda, Madrid - AA.VV. (2008). Instrucción de hormigón estructural EHE-08. Ministerio de Fomento, Madrid - AA.VV. (2008). Guía para el proyecto y la ejecución de micropilotes en obras de carreteras.. Ministerio de Fomento - Ayuso, J. et Alt. (2009). Fundamentos de ingeniería de cimentaciones. Universidad de Córdoba. - Braja M. Das (2001). Principios de Ingeniería de Cimentaciones 4 Ed.. California State University. - Calavera, J. (2001). Muros de contención y muros de sótano. 3ª Ed. (De acuerdo con EHE). INTEMAC, Madrid - Calavera, J. (2015). Cálculo de estructuras de cimentación. 5ª Ed.. INTEMAC, Madrid - Comisión Permanente del Hormigón (2014). Guía de aplicación de la Instrucción del Hormigón Estructural I (EHE-08): edificación. Ministerio de Fomento, Madrid - Fiol Femenia, Francisco; Fiol Oliván, Francisco (2006). Manual de Cimentaciones. Diseño y Cálculo de cimentaciones superficiales y muros, geotécnica y patología.Conforme con el CTE.. Burgos - Freire Tellado, M.; Aragón Fitera, J.; Pérez Valcárcel J.B. (2015). Mecánica del Suelo y Cimentaciones: Ejercicios Resueltos. Reprografía do Noroeste (ISBN978 84 16294 15 2) - Lahuerta Vargas, Javier (). Mecánica del Suelo. Pamplona - Muzás Labad, F (2007). Mecánica del suelo y cimentaciones. Vol I y II. Escuela de la Edificación, Madrid - Pérez Valcárcel, JB. (2004). Excavaciones urbanas y estructuras de contención. C.O.A.G. - C.A.T. / Santiago - Pérez Valcárcel, J. B.; Freire Tellado, M. (2014). Introducción a la Mecánica del Suelo. Reprografía do Noroeste (ISBN 978-84-92794-99-7) - Rodriguez Ortiz - Serra Gesta - Oteo Mazo (1989). Curso Aplicado de Cimentaciones 7 Ed.. Colegio Oficial de Arquitectos de Madrid, COAM - Suárez Riestra, Félix L. (2009). Estudio Geotécnico y Mecánica de Suelos. Acercamiento al Concepto de Terreno como elemento estructural en el mundo de la edificación.. C.G.C.A.A.T.E.E. ISBN: 978-84-612-8003-2 - Aysen,A. (2002). Soil Mechanics: basic concepts and engineering applications.. Balkema Publishers Ed. ISBN-10: 978-0-415-38393-6 - Budhu, M. (2011). Soil mechanics and foundations.. John Wiley&Sons Inc. ISBN-10: 0470556846 - Curtin, W.G.; Shaw, G.;Parkinson, G.I.; Golding, J.M. (2006). Structural foundations designer’s manual.. Curtins Consulting&Blackewll Publishing. ISBN-10:1-4051-3044-X. - Fellenius, B.H. (2006). Basics of foundation design.. Electronic Edition (www.fellenius.net) - Kameswara, N.S.V. (2011). Foundation design, theory and practice.. Wiley Ed. ISBN:978-0-470-82535-1 - Verruijt, A. (2007). Soil Mechanics.. Delft University of Technology. Electronic Edition. (https://www.kau.edu.sa/Files/0001553/files/Soil)
<p>Complementary</p>	

Recommendations

Subjects that it is recommended to have taken before

- Structures 1/630G01019
- Construction 2/630G01020
- Structures 2/630G01023
- Structures 4/630G01034

Subjects that are recommended to be taken simultaneously

- Construction 7/630G01045

Subjects that continue the syllabus

- Final Year Project/630011502

Other comments



(*)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.