

Academic Year/course: 2022/23

## 28620 - Works Equipment

### Syllabus Information

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**Academic Year:** 2022/23

**Subject:** 28620 - Works Equipment

**Faculty / School:** 175 - Escuela Universitaria Politécnica de La Almunia

**Degree:** 422 - Bachelor's Degree in Building Engineering

**ECTS:** 6.0

**Year:** 3

**Semester:** First semester

**Subject Type:** Compulsory

**Module:**

## 1. General information

### 1.1. Aims of the course

Within the studies of Technical Architecture it is essential to know "work equipment and auxiliary means", making known to the students the main characteristics, uses, functions, performances, productions, main components, etc. ., of the equipment, machines and tools that are commonly used in building and urbanization works. With this you will be familiar with the design and planning for the correct choice of said equipment, tools and machinery in each type of work and / or in each phase of the same, as well as its most favorable location.

*These approaches and objectives are in line with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>), in such a way that the acquisition of the course learning outcomes provides training and competence to contribute to their achievement*

*Goal 4: Quality Education*

*Goal 9: Industry, Innovation and Infrastructure*

### 1.2. Context and importance of this course in the degree

The subject of EQUIPMENT OF WORK is part of a group of specific training subjects and mandatory character structured throughout the four courses of the degree, which will provide much of the specific skills and subsequent professional skills of these graduates.

### 1.3. Recommendations to take this course

The current curriculum does not establish any prerequisite to take this subject. However, it would be advisable not only to possess the basic knowledge of mathematics, physics, fundamentals of materials and graphic expression, but also to have completed and / or passed the following subjects:

- Construction Materials I.
- Construction Materials II.
- Structures I and II.
- Building I, II and III.

## 2. Learning goals

### 2.1. Competences

G19 - Apply their knowledge to their job in a professional way and acquire the competences that are usually shown through the production and defense of arguments and problem solving within their area of study.

G20 - Ability to collect and interpret relevant data (usually within their area of study) to make judgments that include thought on relevant issues of a social, scientific or ethical nature

G21 - Transmit information, ideas, problems and solutions to a specialized and non-specialized audience

G22 - Develop those learning skills necessary to undertake further studies with a high degree of autonomy.

G01 - Ability to organize and plan

G02 - Ability to solve problems

G03 - Ability to make decisions

G04 - Aptitude for oral and written communication in their native language

G05 - Ability to analyze and synthesize

G06 - Ability for information management

G07 - Ability for teamwork

G08 - Ability for critical thinking

G09 - Ability to work in an interdisciplinary team

G10 - Ability to work in an international context

G11 - Improvisation and adaptation ability to face new situations

G12 - Leadership skills

G13 - Positive social attitude towards social and technological innovations

G14 - Ability to argue, discuss and present their own ideas

G15 - Ability to communicate through words and images

G16 - Ability to search, analyze and select information

G17 - Ability for self-learning

G18 - Possess and understand knowledge in an area of study that starts at the base of general secondary education, and is usually found at a level, which, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study

CE17 - Ability to program and organize construction processes, construction equipment, and technical and human resources for their execution and maintenance.

## **2.2. Learning goals**

Learn about the most outstanding characteristics of the equipment, machinery and tools, their uses, performances, components, etc., as well as the facilities and auxiliary means necessary for the execution of any building and / or urbanization projects, choosing those that are best adapted to the construction system according to the type of work to be carried out, economic conditions or deadlines.

Have the necessary knowledge for the correct implementation and positioning of machinery so that its use is adequate, particularly in safety conditions, without forgetting the compatibilities that will appear in terms of occupied space and that this is linked to better performance and productivity.

Know how to plan and solve the necessary methods to control the proper use on the working site, as well as be able to calculate the needs for supplies (energy, water, etc.), for the operation of machinery, installations and aided tools.

Be able to apply the technical regulations to the building process and generate technical specification

documents of the building construction procedures and methods.

Calculate the costs coming from the use of machinery and auxiliary means through their depreciation costs, consumables and labor necessary for its operation.

### 2.3. Importance of learning goals

Once the construction aspects are known, the main objective of the course is to determine the most suitable equipment and systems for the different applications based on their safety, functionality, uses and compatibility between them, taking into account budget criteria, benefits and deadlines, without forgetting the implications to be taken into account in terms of depreciation, maintenance and operating expenses during the useful life of equipment and machines.

In each teaching unit practical exercises will be developed, so that the students work in class autonomously, with all the elements of access to information, so that they can develop their ability for synthesis and choice of any equipment (always the most appropriate, proportional and available) for any of the construction systems that they may come across in their future professional life.

## 3. Assessment (1st and 2nd call)

### 3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

Due to the characteristics of the syllabus of this subject with two clearly differentiated blocks, the evaluation will be carried out independently for each of the didactic units, UD I and UD II. Two forms of evaluation will be followed: a continuous one with two exams carried out throughout the semester and a final global evaluation, the latter with two calls (February and September). These evaluations (continuous and final global) are not exclusive, being able to opt for the second in case of not having passed the subject throughout the exams programmed during the course of the semester. A student who passes the two continuous assessment exams will not have to take the final global exam. Those students who do not reach this condition will have to sit the final exam of the two teaching units, even if they have passed one of them through continuous evaluation (regardless of the grade obtained). The final grade to be recorded in the minutes, in case of being "suitable" in both UD, s, will be the result of averaging the qualifications obtained in both. In both modalities of qualification, continuous and global final, the student must deliver the assignments that have been entrusted during the course. Failure to deliver any of these works will mean the loss of the right to correct the exam.

The works will be carried out in teams of 2 students expressly designated by the teacher and their content, definition and delivery conditions will be published through the Moodle platform. These works will have a percentage value of 10% on the final grade in each of the didactic units:

• UD I	evaluation	(65 %	grade):
EV - I or UD - I	EV - F - I	exam	90 %
	works		10 %
• UD II	evaluation	(35 %	grade):
EV - II or UD-II works 10%	EV - F - II	exam	90 %

**In global assessment test** the following points the approximate weights of the evaluation process are shown:

- Projects / Mandatory tasks 10%
- Final Assessment Test 90%

Parts or notes will not be saved from one academic year to another.

## 4. Methodology, learning tasks, syllabus and resources

### 4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, practice sessions, tutorials, autonomous work and study, and exams.

*"The approach, methodology and assessment of this guide are intended to be the same for any teaching scenarios. They will be adapted to the social-health situation at any particular time, as well as to the instructions*

given by the authorities concerned".

## 4.2. Learning tasks

The course consists of 6 ECTS credits, which represents 150 hours of student work in the course during the semester. 40% of this work (60 h.) Will be done in the classroom, and the rest will be autonomous. A semester will consist of 15 teaching weeks. To make the temporal distribution, the teaching week is used as a measure, in which the student must dedicate 10 hours to the study of the subject.

- Theoretical classes 26 hours
- Practical classes 16 hours
- Individual tutored practices 11 hours
- Evaluations 7 hours
- Individual non-contact work 90 hours

## 4.3. Syllabus

This course will address the following topics:

### **SECTION I: EARTH MOVING METHODS**

#### **TOPIC 1. EARTH MOVING MACHINERY**

- 1.1. Earth moving basic operations and machinery
- 1.2. Land classification based on their hardness
- 1.3. Advantages and limitations of the earth moving machines
- 1.4. Machinery choice
- 1.5.
- 1.6. Mechanization of works

#### **TOPIC 2. EARTH VOLUMES**

- 2.1. Earth volume changes
- 2.2. Swelling and swelling factor
- 2.3. Consolidation and compaction
- 2.4. Swelling values
- 2.5. Practical considerations in soil layer extension
- 2.6. Land clearing and land filling.
- 2.7. Land movement cuttings and landfills
- 2.8. Cross section areas
- 2.9. Determining the mass to be moved between two profiles
- 2.10. Mass diagram
- 2.11. Soil compensation

#### **TOPIC 3. MACHINE TRACTION REQUIREMENTS**

- 3.1. Required traction
- 3.2. Balance between available and usable tractions
- 3.3. Resistance to traction
- 3.4. Speed calculation. Motion Equation.
- 3.5. Practical exercises

#### **TOPIC 4. PRODUCTION AND COST OF THE MACHINERY**

- 4.1. Cost Calculation of the work unit
- 4.2. Definition of the production
- 4.3. Cost of using machinery

#### **TOPIC 5. EXCAVATION AND PUSHING: DOZER**

- 5.1. Models and scope
- 5.2. Mechanical properties
- 5.3. Working equipment
- 5.4. Production cycle
- 5.5. Working capabilities
- 5.6. Excavation and pushing distances
- 5.7. Calculating dozer production
- 5.8. Excavation and pushing techniques
- 5.9. Ripping techniques
- 5.10. Practical exercises

#### **TOPIC 6. EXCAVATION AND LOADING: FRONT LOADER**

- 6.1. Definition, types and applications
- 6.2. Front loader elements and working equipment
- 6.3. Characteristic parameters
- 6.4. Working cycle
- 6.5. Buckets

6.6. Calculating front loader production  
 6.7. Match factor  
 6.8. Practical exercises

**TOPIC 7. LOADING AND HAULING: SCRAPERS**

7.1. Scraper functions  
 7.2. Scraper types and fields of application  
 7.3. Scraper elements and working equipment  
 7.4. Production cycle  
 7.5. Excavation methods  
 7.6. Different ways of working  
 7.7. Working tips  
 7.8. Calculating scraper production  
 7.9. Match factor  
 7.10. Practical exercises

**TOPIC 8. EXCAVATION MACHINERY: EXCAVATORS**

8.1. Definition, types and applications  
 8.2. Hydraulic excavators  
 8.3. Cable excavators  
 8.4. Practical exercises

**TOPIC 9. HAULING: TRUCKS AND DUMPERS**

9.1. Typology  
 9.2. Dump trucks  
 9.3. Dump semi-trailers  
 9.4. Dumpers  
 9.5. Off-road dumpers: rigid frame and articulated rear-dump trucks  
 9.6. Dump bodies  
 9.7. Hauling cycle and match factor  
 9.8. Calculating dumpers production  
 9.9. Practical exercises  
 9.10. Transport of heavy machinery

**TOPIC 10. FINISHING EQUIPMENT: GRADERS**

10.1. Definition and field of applications  
 10.2. Grader elements  
 10.3. Working equipment  
 10.4. Grader operations  
 10.5. Calculating grader production  
 10.6. Practical exercises

**TOPIC 11. COMPACTION**

11.1. Types of compacting equipment  
 11.2. Compacting diagram  
 11.3. Compacting methods  
 11.4. Factors affecting compactation  
 11.5. Compaction specifications and control  
 11.6. Compaction tests  
 11.7. Calculating compaction production  
 11.8. Compaction tips  
 11.9. Selecting a compactor  
 11.10. Practical exercises

**SECTION II: GENERAL CONSTRUCTIVE PROCEDURES**

**TOPIC 12. AUXILIARY EQUIPMENT**

12.1. Electric generator  
 12.2. Air compressors and hammers  
 12.3. Equipment for pumping water  
 12.4. Gas cutting procedures  
 12.5. Welding procedures  
 12.6. Rock and soil drilling machinery

**TOPIC 13. AGGREGATE PRODUCTION**

13.1. General information:  
 13.2. Aggregate production machinery  
 13.3. Calculating aggregate production  
 13.4. Aggregates classification: Screeners  
 13.5. Aggregates washing  
 13.6. Feeders and belt conveyors  
 13.7. Surge piles  
 13.8. Facilities  
 13.9. Practical exercises

## TOPIC 14. FLEXIBLE PAVEMENTS: MACHINERY AND EXECUTION

- 14.1. Soil stabilization
- 14.2. Bituminous coats: prime, tack and seal
- 14.3. Aggregate and bituminous coats
- 14.4. Bituminous concrete

## TOPIC 15. CONCRETE: EQUIPMENT AND PLACING

- 15.1. Concrete mixers
- 15.2. Concrete plants
- 15.3. Execution: Concrete and pumping
- 15.4. Execution: Consolidating and finishing
- 15.5. Execution: Concrete pavements
- 15.6. Execution: Shotcrete

## TOPIC 16. TIMBERING, FORMWORK AND FALSEWORK

- 16.1. Timbering
- 16.2. Formwork
- 16.3. Concrete reinforcement
- 16.4. Falsework

## TOPIC 17. CRANES AND LIFTING SYSTEMS

- 17.1. Introduction
- 17.2. Major crane types
- 17.3. Mobile cranes:
- 17.4. Tower cranes

## TOPIC 18. PRACTICAL EXAMPLES OF CONSTRUCTION METHODS

### 4.4. Course planning and calendar

The course consists of 6 ECTS credits which represent 150 hours of work of the student in this course, ie 10 hours per week during 15 weeks of teaching of the course.

From week 1 to 9 first section of the syllabus will be studied and an assessment will take place in the 9th week. From week 10 to 15 we will study the second section of the syllabus and a later assessment of this section will take place.

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of EUPLA website and Moodle.

### 4.5. Bibliography and recommended resources

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28620>