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| Course Unit | Design in Hydraulic Engineering | | Field of study | Fluid Mechanics and Hydraulics | |
| Master in | Construction Engineering | | School | School of Technology and Management | |
| Academic Year | 2023/2024 | Year of study | 1 | Level | 2-1 |
| Type | Semestral | Semester | 2 | ECTS credits | 6.0 |
| Code | 5024-419-1205-00-23 | | | | |
| Workload (hours) | 162 | Contact hours | T - | TP 60 | PL - |
| | | | TC - | S - | E - |
| | | | OT - | O - | |

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Carlos Liberal Moreno Afonso

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Know how about hydrology concepts: hydrological cycle, watershed, precipitation; study of flow rates and flooding.
2. Identify different phases connection to the flow of surface water, water management and storm water drainage in urban areas.
3. Spotting all the constituent elements of sanitation systems, apply the laws of the Hydraulic to the study of such systems.
4. Using the methods studied in the design of the main organs of a sanitation systems.
5. Identify normative requirements, as well as, construction techniques of the various constituent organs of a sewerage system; Produce the necessary elements for the elaboration of a project.
6. Distinguish all the elements of the longitudinal and cross drainage systems in roads.
7. Apply the laws of hydraulics in the sizing of the various organs of these systems and identify regulatory requirements, as well as construction techniques.
8. Applying water energy technologies.

Prerequisites

Before the course unit the learner is expected to be able to:

1. Perform functional analysis, numerical calculation, integral, differential and vector.
2. Have knowledge of linear algebra and analytical geometry.
3. Apply the concepts of General and Applied Hydraulics.

Course contents

Applied hydrology; Drainage systems of waste water; Drainage systems of stormwater; Drainage systems in roads; Technologies associated with the energy of water: Hydraulic plants, tidal and wave energy.

Course contents (extended version)

1. Chapter I - Applied Hydrology
 - Hydrologic Cycle; Basin River; Precipitation, Infiltration, Evaporation and Evapotranspiration.
 - Surface Runoff; Regime of Watercourses; Flood Forecasting.
 - Flood Control and Flooding.
2. Chapter II - Drainage Systems Waste Water
 - Introduction, Design of Drainage Systems Wastewater: Branches Liaison; Collectors.
 - Interceptors and Outfalls; Bodies Accessories: Visit Chambers.
 - Storm Dischargers; Inverted Siphons; Pumping Instalations.
 - Study of Sketch of Networks Drainage; Project Flow Rate.
 - Sizing Hydraulic of Drainage Systems Wastewater.
 - Checking of Regulatory Constraints; Deployment of Collectors.
 - Calculation of the Conditions of flow.
3. Chapter III - Drainage Systems Stormwater
 - Introduction; Flow Rate Stormwater; Time of Concentration; Rainfall Intensity.
 - Recurrence Time or Period Return; Runoff Coefficient; Evaluation of Flow Rate.
 - Hydraulic Calculation of Collectors; Collectors; Galleries and Accessories Bodies.
 - Design of a Drainage System Rainwater.
4. Chapter IV - Drainage Systems in Roads
 - Longitudinal Drainage: Introduction; General Conception; Hydraulic Constraints.
 - Hydraulic Sizing; Spacing between devices with lateral Discharge.
 - Transversal Drainage: Introduction; Factors of Choice of Transversal Drainage Devices.
 - Conditions on Location in Plan and in Profile; Conditions of flow.
 - Hydraulic Design; Protections; Example of Practical Application.
5. Chapter V - Energy of Water
 - Presentation of the Technologies Associated to Water Energy: Hydro Plant,
 - Tidal and Wave Energy.

Recommended reading

1. LENCASTRE, A. e FRANCO, F. M. – Lições de Hidrologia. Lisboa, Universidade Nova de Lisboa, 2ª Edição revista, Faculdade de Ciências e Tecnologia, 1992.
2. AZEVEDO, J. – Sebenta de Hidrologia Aplicada. Bragança, IPB, Rev. 2012.
3. LINSLEY, Jr. R. K. , KOHLER, M. A. e PAULHUS, J. L. M. – Applied Hydrology. N. York, McGraw-Hill Book, 1949.
4. ROBERSON, J. A. , CASSIDY, J. J. e CHAUDHRY, M. H. – Hydraulic Engineering. N. York, John Wiley & Sons, Inc, 1998.
5. SA MARQUES, J. A. A. e SOUSA, J. J. O. – Hidráulica Urbana. Sistemas de Abastecimento de Água e de Drenagem de Águas Residuais, 3ªedição, Coimbra, Imprensa da Universidade de Coimbra, 2011.

Teaching and learning methods

The curricular unit is taught using lectures and practical classes with resolution of exercises and support to the elaboration of the practical works for evaluation.

Assessment methods

1. Normal and supplementary seasons: - (Regular, Student Worker) (Final, Supplementary)
 - Practical Work - 25% (Practical work 1)
 - Practical Work - 25% (Practical work 2)
 - Final Written Exam - 50% (10 points with a minimum grade of 35% in the written exam)
2. Special seasons: - (Regular, Student Worker) (Special)

Assessment methods

- Final Written Exam - 100%

Language of instruction

Portuguese

Electronic validation

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| Carlos Liberal Moreno Afonso | Debora Rodrigues de Sousa Macanjo Ferreira | Manuel Teixeira Brás César | José Carlos Rufino Amaro |
| 08-03-2024 | 12-03-2024 | 13-03-2024 | 16-03-2024 |

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