Course guide
2500217 - GEA0217 - Atmospheric Processes and Hydrology

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.
Degree: BACHELOR’S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2020). (Compulsory subject).
Academic year: 2022 ECTS Credits: 6.0 Languages: Spanish

LECTURER
Coordinating lecturer: MANUEL GOMEZ VALENTIN
Others: MANUEL GOMEZ VALENTIN, GONZALO JAVIER OLIVARES CERPA, DANIEL SEMPERE TORRES

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14445. Recognize the biological bases and foundations of the plant and animal field in engineering: notions of genetics, biochemistry and metabolism, physiology, organisms and environment, population dynamics, flows of matter and energy and changes in ecosystems, biodiversity, principles of the kinetics of microbial growth and reactor theory.
14447. Obtain basic knowledge about the use and programming of computers, operating systems, databases and basic numerical calculation and applied to engineering.
14451. Apply the fundamental concepts of statistics and randomness of physical, social and economic phenomena, as well as uncertainty and decision-making techniques.
14452. Enhance the capacity of spatial vision and identify the techniques of graphic representation, topography, photogrammetry, cartography, remote sensing and Geographic Information systems.
14453. Describe and apply the techniques of analysis of physical, chemical and biological parameters; Integrate the experimental evidence found in field and/or laboratory data with the theoretical knowledge and interpret its results.
14454. Formulate the principles of fluid mechanics and the fundamentals of continuous medium mechanics.
14455. Identify the concepts and technical aspects linked to the conduit systems, both in pressure and in free sheet and apply them to the water supply transport networks; pumping systems; unit networks; separative networks; Avenues prevention systems in urban areas and analysis of tools for the recovery of altered river and coastal spaces.
14456. Describe the processes linked to the water cycle: atmospheric circulation and rain formation; rain transformation into runoff; and apply them to surface and underground hydrology associated with avenues risk, surface water pollution, aquifer management and groundwater pollution.

General:
14440. Identify, formulate and solve problems related to environmental engineering.
14441. Apply the functions of consulting, analysis, design, calculation, project, construction, maintenance, conservation and exploitation of any action in the territory in the field of environmental engineering.
14442. To use in any action in the territory proven methods and accredited technologies, in order to achieve the greatest efficiency respect for the environment and the protection of the safety and health of workers and users.
TEACHING METHODOLOGY

The course consists of 2.3 hours per week of classroom activity (large size group) and 1.2 hours weekly with half the students (medium size group).

The 2.3 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 1.2 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

LEARNING OBJECTIVES OF THE SUBJECT

The water cycle in its atmospheric and surface component will be studied. Thus, the bases of atmospheric circulation, its relationship with the formation of waves and currents in the sea, as well as the relationship of the climate with extreme events (droughts and flood risk) will be raised. The processes and methods of transforming rain into runoff will be analyzed. Finally, the main processes of surface water contamination will be considered, thus giving an overview of surface hydrology in general and providing the capacity for its application to engineering problems.

1. Understand the fundamentals of atmospheric circulation and the relationships of climate with extreme events (droughts and flood risk).
2. Apply methods associated with the atmospheric and surface water cycle for surface hydrological modeling: transformation methods of rain in runoff and flood propagation methods.
3. Know the main processes of surface water contamination by anthropic origin, by degradation of organic matter (hypoxia, anoxia) or eutrophication.

Atmospheric Processes and Hydrology. The water cycle in its atmospheric and surface component will be studied. Thus the bases of atmospheric circulation will be raised, its relation with the formation of waves and currents in the sea, as well as the relation of the climate with extreme episodes (droughts and flood risk). I know they will analyze the processes and methods of transforming rain into runoff. Finally, the main processes of surface water contamination will be considered.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.00</td>
</tr>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
</tbody>
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Total learning time: 150 h
**CONTENTS**

### Atmospheric processes

**Description:**
- Water Engineering
- Water as a resource and as a risk
- Atmospheric circulation
- Hadley cells
- Movement of fronts
- Water vapor
- Steam in an atmospheric column
- Precipitable water

**Full-or-part-time:** 72h
- Theory classes: 30h
- Self study: 42h

### Precipitation and watershed analysis

**Description:**
Introduce the student to general concepts of atmospheric circulation as well as, formation and types of precipitation

**Full-or-part-time:** 2h 24m
- Theory classes: 1h
- Self study: 1h 24m

### The IDF curves. Rational method

**Description:**
- Introduce the student to the analysis of extreme rainfall data: intensity curves - duration - frequency
- Present the IDF or DDF curves and propose exercises with their information
- Introduce the student to the typical types of project rains and compare results for the various types

**Full-or-part-time:** 14h 23m
- Theory classes: 3h 30m
- Practical classes: 1h 30m
- Laboratory classes: 1h
- Self study: 8h 23m

### Net Rain: Precipitation Losses

**Description:**
- Present to the student the common loss processes in a basin
- Present the interception process. Ways to quantify it
- ET estimation procedures. ETo and real ET.
- Present the concept of the information model. Field tests to characterize it
- Show the student the model of the curve number, based on the S proposal
- Exercises to obtain net rain from NC and other loss models

**Full-or-part-time:** 21h 36m
- Theory classes: 6h
- Practical classes: 2h
- Laboratory classes: 1h
- Self study: 12h 36m
Rain - flow transformation

**Description:**
- Runoff calculation: unit hydrograph, reservoir model and kinematic wave models
- Concept of unit hydrograph, really synthetic. Obtaining from field measurements
- Synthetic unit hydrograph concept. SCS procedures. H Synthetic Clark unit

**Full-or-part-time:** 14h 23m
- Theory classes: 6h
- Self study: 8h 23m

Propagation in natural channels

**Description:**
- Propagation in channels and lamination effect produced by reservoirs as a protection solution against floods
- Hydrological methods of propagation: Muskingum. Formulation, time steps, subreaches,
- HMS hydrological model Public domain model
- Course work with HMS. Dam design and its associated reservoir

**Full-or-part-time:** 19h 12m
- Theory classes: 6h
- Practical classes: 2h
- Self study: 11h 12m

**GRADING SYSTEM**

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

**BIBLIOGRAPHY**

**Basic:**

**Complementary:**