Course guide
2500043 - GECCINFTRA - Construction of Transportation Infrastructure

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

LECTURER
Coordinating lecturer: ADRIANA HAYDEE MARTINEZ REGUERO
Others: ADRINA BACHILLER SAÑA, ADRIANA HAYDEE MARTINEZ REGUERO

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14422. Capacity for the construction and conservation of roads, as well as for the dimensioning, the project and the elements that make up the basic road equipment. (Specific technology module: Urban Transport and Services)
14423. Capacity for the construction and conservation of railway lines with knowledge to apply specific technical regulations and differentiating the characteristics of the mobile material. (Specific technology module: Urban Transport and Services)
14425. Knowledge of the influence of infrastructure in the planning of the territory and to participate in the urbanization of urban public space, such as water distribution, sanitation, waste management, transport systems, traffic, lighting, etc. (Specific technology module: Urban Transport and Services)
14426. Knowledge of the design and operation of infrastructures for modal exchange, such as ports, airports, railway stations and transport logistics centers. (Specific technology module: Urban Transport and Services)

General:
14380. Scientific-technical training for the exercise of the profession of Technical Engineer of Public Works and knowledge of the functions of advice, analysis, design, calculation, project, construction, maintenance, conservation and exploitation.
14383. Ability to project, inspect and direct works, in their field.
14385. Ability to carry out territorial planning studies and environmental aspects related to infrastructure, in its field.
14386. Capacity for maintenance, conservation and exploitation of infrastructure, in its field.
14389. Knowledge of the history of civil engineering and training to analyze and assess public works in particular and construction in general.
14391. Conceive, project, manage and maintain systems in the field of construction engineering. Cover the entire life cycle of an infrastructure or system or service in the field of construction engineering. (Additional school competition).

TEACHING METHODOLOGY

The course consists of 4 hours per week of classroom activity.

The 2.5 hours are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, and the 0.9 hours are devoted to show examples and solves exercises (average).

The rest of weekly hours devoted to tests.

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

Development at the specialization level of the basic concepts acquired in transport infrastructure in the preceding subject of Transport Technology.

1. Capacity for road design and construction.
2. Capacity for the organization of passenger transport by rail.
3. Capacity to carry out a railway infrastructure project including the layout and design of the elements that make up the section.

Development at the specialization level of the basic concepts acquired in transport infrastructure in the preceding subject of Transport Technology. Extension of contents related to roads. Construction of Clearades. Construction of firm. Work units. Innovations in materials and work units. Railroads: circulation in curve and speed increase; Geometric quality; Vertical efforts and road design; Road appliances; Bridges and tunnels; Organization of passenger transport and freight transport; The movement of a train; Start and circulation at a constant speed; Brated, geometric planning criteria of a line; Signalling and railway protection systems; ATO, driverless and unattended; ERTMS; Operating systems and line capacity; Scheduling of the rail service; Construction and renovation of a railway line; Environment, noise and vibration; The electrification of a line. Design criteria.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours medium 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>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
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</tbody>
</table>

Total learning time: 150 h

CONTENTS

0. Presentation

**Description:**
Objectives, faculty, calendar, evaluation system, bibliography.

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

1. ROADS. Earthworks construction

**Description:**
Pavement design
Specifications implementation.
Soil stabilized design, specifications application.

**Full-or-part-time:** 12h
- Theory classes: 3h
- Practical classes: 2h
- Self study: 7h
### 2. Aggregates

**Description:**
Production and quality control. Specifications.

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

### 3. Hydrocarbon binders

**Description:**
Production. Specifications and applications.

**Full-or-part-time:** 4h 48m  
Theory classes: 2h  
Self study: 2h 48m

### 4. Granular layers

**Description:**
Preparation of granular bases, laying and compaction, quality control. Specifications.

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

### 5. Cement treated gravel

**Description:**
Manufacture, laying and compaction, quality control work. Specifications. Problems of cement treated bases.

**Full-or-part-time:** 7h 11m  
Theory classes: 1h  
Practical classes: 2h  
Self study: 4h 11m

### 6. Bituminous surface treatments and slurry seals

**Description:**

**Full-or-part-time:** 4h 48m  
Theory classes: 1h  
Practical classes: 1h  
Self study: 2h 48m
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Description</th>
<th>Full-or-part-time</th>
<th>Theory classes</th>
<th>Practical classes</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Bituminous mixtures</td>
<td>Hot and cold mix asphalt. Design criteria. Laying, compaction and quality control of bituminous mixtures. Specifications. Problems of bituminous mixtures.</td>
<td>9h 36m</td>
<td>2h</td>
<td>2h</td>
<td>5h 36m</td>
</tr>
<tr>
<td>8. Cement concrete pavements</td>
<td>General characteristics. Manufacture, laying, compaction and quality control. Specifications. Cement concrete pavement problems.</td>
<td>9h 36m</td>
<td>2h</td>
<td>2h</td>
<td>5h 36m</td>
</tr>
<tr>
<td>9. Innovations in materials and work units in road pavements</td>
<td>Innovations in materials and work units in road pavements</td>
<td>7h 11m</td>
<td>3h</td>
<td></td>
<td>4h 11m</td>
</tr>
<tr>
<td>10. Port pavements and airport runways</td>
<td>Port pavements Airport runways</td>
<td>9h 36m</td>
<td>4h</td>
<td></td>
<td>5h 36m</td>
</tr>
<tr>
<td>11. RAILWAYS. Presentation and Introduction</td>
<td>Presentation and Introduction</td>
<td>4h 48m</td>
<td>2h</td>
<td></td>
<td>2h 48m</td>
</tr>
</tbody>
</table>
### 12. Structures: bridges and tunnels

**Description:**

**Full-or-part-time:** 4h 48m  
Theory classes: 2h  
Self study : 2h 48m

### 13. The movement of a train

**Description:**
Problems.

**Full-or-part-time:** 14h 23m  
Theory classes: 4h  
Practical classes: 2h  
Self study : 8h 23m

### 14. Signaling and railway protection systems

**Description:**
Principles of signaling and protection systems. Description of protection systems in conventional lines. First protection systems in high speed lines. ERTMS. Interoperability. ETCS levels.

**Full-or-part-time:** 7h 11m  
Theory classes: 3h  
Self study : 4h 11m

### 15. Automatic train operation

**Description:**
ATO, driverless and unattended. ATP Speed Control Systems. Degrees of driving automation: ATO, Driverless, Unattended. CBTC.

**Full-or-part-time:** 4h 48m  
Theory classes: 2h  
Self study : 2h 48m

### 16. The electrification of a line

**Description:**
Criteria for the electrification of a line. Typology of current collection systems. Basic design parameters of the electrification of a line. Problems arising from the pantograph-catenary interaction.

**Full-or-part-time:** 4h 48m  
Theory classes: 2h  
Self study : 2h 48m
17. Scheduling of the railway service

Description:
Problems.

**Full-or-part-time:** 4h 48m
Theory classes: 1h
Practical classes: 1h
Self study: 2h 48m

18. Operating systems and line capacity

Description:
Methodologies for evaluating the capacity of a line. Minimum interval between circulations. Saturation of a line. Measures to increase the capacity of a line.
Problems.

**Full-or-part-time:** 4h 48m
Theory classes: 1h
Practical classes: 1h
Self study: 2h 48m

19. Organization of passenger transport

Description:
Suburban and regional services. Conventional and high-speed intercity services.

**Full-or-part-time:** 7h 11m
Theory classes: 3h
Self study: 4h 11m

20. Organization of the transport of goods

Description:
The railway as a logistics agent. Intermodal transport. Infrastructure and terminals for the transport of goods.

**Full-or-part-time:** 9h 36m
Theory classes: 4h
Self study: 5h 36m

21. Passenger stations

Description:
Typology and evolution of the station. Basic elements to be defined in a railway station.

**Full-or-part-time:** 4h 48m
Theory classes: 2h
Self study: 2h 48m
GRADING SYSTEM

For assessment purpose, the course consists of three parts:

- Roads (C)
- Railways (FC)

During the semester of the course there will be two tests for each of the two parts that will be taught in parallel. There will also be an assessable activity (A) that will be evaluated for the (C) part, which will be weighted as 30% of the corresponding mark.

An average mark will be obtained from each part (C or CF). The mark of the each part will be obtained from the corresponding exams (and assessable activity in the case of C):

\[
\text{Mark (C)} = 0.70 \times \frac{(\text{mark C1 + mark C2})}{2} + 0.30 \times \text{mark A} \\
\text{Mark (FC)} = \frac{\text{mark ExFC1 + mark ExFC2}}{2}
\]

The overall course mark (MARK) will be obtained as:

\[
\text{MARK} = \frac{\text{Mark (C)} + \text{Mark (FC)}}{2}
\]

In the case that the student does not attend one of these tests, with the aim of calculating the MARK, the mark of that part will be considered zero.

To pass the course, the student's course mark must be \( \geq 5 \).

In addition there will be a retaking exam at the end of the semester, for those students with a mark below 5.0.

The MARK will be NP when the student does not attend the retaking exam.

EXAMINATION RULES.

Students who do not attend any of the exams of the subjects will not have a numerical mark and their qualification will be NP.

BIBLIOGRAPHY

Basic: