

Course guide

2500043 - GECCINFTRA - Construction of Transportation Infrastructure

Last modified: 01/10/2023

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: 2023 **ECTS Credits:** 6.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: ADRIANA HAYDEE MARTINEZ REGUERO
Others: ADRINA BACHILLER SAÑA, TERESA LÓPEZ MONTERO, 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)

Generical:

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.
14390. Identify, formulate and solve engineering problems. Pose and solve construction engineering problems with initiative, decision-making skills and creativity. Develop a systematic and creative method of analysis and problem solving. (Additional school competition).
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 1.5 hours are devoted to show examples and solves exercises (average).

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.

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

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

Type	Hours	Percentage
Hours large group	30,0	20.00
Self study	84,0	56.00
Hours medium group	30,0	20.00
Guided activities	6,0	4.00

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

Previous operations to earthmoving. Landfills and rockfills. Soil compaction machinery. Quality control. Completion and refinement. Protection against erosion.

Specifications implementation .

Soil stabilization with lime and cement. Stabilization execution. Specifications.

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:

Bituminous surface treatments and slurry seals. Quality control. Specifications.
Problems of surface treatments.

Full-or-part-time: 4h 48m

Theory classes: 1h

Practical classes: 1h

Self study : 2h 48m

7. Bituminous mixtures

Description:

Hot and cold mix asphalt. Design criteria. Laying, compaction and quality control of bituminous mixtures. Specifications.
Problems of bituminous mixtures.

Full-or-part-time: 9h 36m

Practical classes: 2h

Laboratory classes: 2h

Self study : 5h 36m

8. Cement concrete pavements

Description:

General characteristics. Manufacture, laying, compaction and quality control. Specifications.
Cement concrete pavement problems.

Full-or-part-time: 9h 36m

Theory classes: 2h

Practical classes: 2h

Self study : 5h 36m

9. Innovations in materials and work units in road pavements

Description:

Innovations in materials and work units in road pavements

Full-or-part-time: 7h 11m

Theory classes: 3h

Self study : 4h 11m

10. Port pavements and airport runways

Description:

Port pavements

Airport runways

Full-or-part-time: 9h 36m

Theory classes: 4h

Self study : 5h 36m

11. RAILWAYS. Presentation and Introduction

Description:

Presentation and Introduction

Full-or-part-time: 4h 48m

Theory classes: 2h

Self study : 2h 48m

12. Structures: bridges and tunnels

Description:

Bridges: Typology. Specific problems of concrete railway bridges. Main differences between railway and road bridges. Limitation of arrows on railway bridges. Tunnels: Typology and examples. Aerodynamic phenomena. Determination of the cross section.

Full-or-part-time: 4h 48m

Theory classes: 2h

Self study : 2h 48m

13. The movement of a train

Description:

Start and circulation at constant speed. Resistance to the advance of a vehicle. Towable load for a train at start-up and at constant speed. Resistances to the advance of high speed trains. Power required. Towable load. Main aspects of braking a train. Evolution and development of braking systems. High speed braking. Geometric planning criteria of a line. Geometric parameters for the design of new lines. Influence of the operating system. 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:

Progress charts Itinerary books. Planning of staff shifts and rolling stock cycles. 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 purposes, the subject consists of two parts:

- Roads (C)
- Railways (FC)

During the four-month period in which the subject is taught, two mid-term exams will be held for each of the two parts. A directed activity will also be assessed for each.

For each part (C or FC), an average mark will be obtained from the marks obtained in each of the exams and the assessable activity: in each part, the mark for the mid-term exams will be weighted with 80% and the mark for the assessable activity with 20%.

The grade for the subject will be the arithmetic mean of the grade obtained in each of these two subjects (C and FC).

In order to pass, the grade for the subject must be equal to or higher than 5.0.

In addition, once the course has been completed, a re-evaluation exam will be held for those students whose grade in the subject is lower than 5.0.

Grading criteria and admission to the re-evaluation: students failed in the ordinary assessment who have regularly sat the assessment tests for the failed subject will have the option to take a re-evaluation test in the period set in the academic calendar. Students who have already passed the re-evaluation test of a subject and students who have been marked as failed may not take the re-evaluation test of a subject. The maximum grade in the case of taking the re-evaluation exam shall be five (5.0) and shall be the grade obtained only in the re-evaluation exam. The non-attendance of a student summoned to the re-evaluation test, held in the fixed period, may not give rise to the taking of another test at a later date. Extraordinary evaluations will be carried out for those students who, due to accredited force majeure, have not been able to take any of the continuous assessment tests.

These tests must be authorised by the corresponding Head of Studies, at the request of the lecturer responsible for the subject, and will be held within the corresponding teaching period.

BIBLIOGRAPHY

Basic:

- Kraemer, C. Ingeniería de carreteras: v. II. Madrid: Mc Graw Hill, 2003. ISBN 84-481-3998-4.
- Dirección General de Carreteras del Ministerio de Fomento. Pliego de prescripciones técnicas generales para obras de carreteras y puentes. Ministerio de Fomento, 2004. ISBN 8449807301.
- Oliveros Rives, F.; Rodríguez Méndez, M.; Megía Puente, M. Tratado de ferrocarriles: vol. 2. Madrid: Rueda, 1980. ISBN 978-84-7207-015-8.
- Recuenco Aguado, E. Firmes y pavimentos : de carreteras y otras infraestructuras. Madrid: Colegio de Ingenieros de Caminos, Canales y Puertos, 2014. ISBN 978-84-1545-283-6.
- López Pita, A. Infraestructuras ferroviarias [on line]. Barcelona: Edicions UPC, 2006 [Consultation: 09/03/2021]. Available on: <http://hdl.handle.net/2099.3/36850>. ISBN 8483018535.
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