

Course guide

340736 - INFE - Railway Infrastructure

Last modified: 22/06/2026

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING AND RAILWAY SYSTEMS (Syllabus 2024).
(Compulsory subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: Lluís Monjo
Others: Zacarías Grande
Carlos Flores

PRIOR SKILLS

Railway system basic knowledge and basic calculus

REQUIREMENTS

No previous knowledge is necessary

TEACHING METHODOLOGY

Through expository sessions, the basic concepts will be introduced and activities will be carried out in the form of problems and/or exercises. The implementation of challenges during the course is planned.

LEARNING OBJECTIVES OF THE SUBJECT

The objectives of the subject are:

- (1) to develop basic knowledge of the elements that make up the railway infrastructure and their characteristics
- (2) knowledge of the mechanical behavior of a track in the face of vertical forces
- (3) knowledge of the dimensioning of the infrastructure and superstructure of the track
- (4) to carry out a layout project, both in plan and elevation of an infrastructure
- (5) financing of railway infrastructures
- (6) railway infrastructure maintenance

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	20.00
Self study	90,0	60.00
Hours small group	30,0	20.00

Total learning time: 150 h

CONTENTS

Introduction

Description:

General concepts

Full-or-part-time: 2h

Theory classes: 2h

Railway guide

Description:

Effect of taper and comparison with other modes.

Full-or-part-time: 4h

Theory classes: 4h

Railway infrastructure geometry

Description:

Straight lines (inclinations), curves (radii, theoretical superelevation, insufficient and excessive superelevation), transitions and regulations

Full-or-part-time: 16h

Theory classes: 6h

Self study : 10h

Land preparation

Description:

Embankments, cuttings, viaducts, tunnels, transition wedges and drainage

Full-or-part-time: 12h

Theory classes: 4h

Self study : 8h

Rails and elements

Description:

Infrastructure (granular layers, geotextile, sub-ballast) and Superstructure (ballast, slab, sleepers, fastenings, rail). Typical sections and regulations

Full-or-part-time: 6h

Theory classes: 6h

Track apparatus

Description:

Detours, crossings, expansion and regulations

Full-or-part-time: 4h

Theory classes: 4h

Track mechanics

Description:

Traditional methods, Zimmermann-Timoshenko and Unlod-Lorente of No

Full-or-part-time: 16h

Theory classes: 6h

Self study : 10h

Track dynamics

Description:

Vehicle diagram. Vertical (wheel-rail, comfort, noise, ballast deterioration), transverse and longitudinal interaction

Full-or-part-time: 6h

Theory classes: 6h

Track construction

Description:

Track on ballast and slab. Geometric control, monitoring and regulations

Full-or-part-time: 4h

Theory classes: 4h

Track maintenance

Description:

Technical/economic importance, machinery, swath trains and maintenance strategies

Full-or-part-time: 14h

Theory classes: 4h

Self study : 10h

System interaction

Description:

Line of contact (LAC), signaling (CMS and ERTMS) and clearances

Full-or-part-time: 14h

Theory classes: 4h

Self study : 10h

Terminals and stations

Description:

Typologies and functional design of track and escape routes

Full-or-part-time: 6h

Theory classes: 6h

City integration

Description:

Vibrations, environmental impact, underground works and case studies

Full-or-part-time: 16h

Theory classes: 6h

Self study : 10h

Project

Description:

Design of a railway infrastructure

Full-or-part-time: 30h

Self study : 30h

GRADING SYSTEM

The final grade for the subject will be calculated based on:

$$QF = \text{MID_TERM} \cdot 0.3 + \text{FINAL} \cdot 0.3 + \text{ACTIVITIES} \cdot 0.4$$

EXAMINATION RULES.

Activities are NOT re-evaluable, only exams are re-evaluable.

BIBLIOGRAPHY

Basic:

- Oliveros Rives, Fernando; Megia Puente, Manuel J; López Pita, Andrés; Rodríguez Méndez, Manuel. Tratado de ferrocarriles. Madrid: Rueda, 1977-1980. ISBN 9788472070158.
- Profillidis, V. A. Railway planning, management, and engineering . Fifth edition. ©2022. ISBN 9780429329302.
- Esveld, Coenraad. Modern railway track . 2nd ed. Zaltbommel : MRT, 2001. ISBN 9080032433.
- Pyrgidis, Christos N. Railway transportation systems : design, construction and operation . 2nd ed. ©2022. ISBN 9781003046073.
- Manuel Melis Maynar. Apuntes de introducción a la dinámica vertical de la vía y a las señales digitales en ferrocarriles . 2008. ISBN 9788461276868.
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