Course guide
230093 - TD - Data Transmission

Last modified: 07/06/2025

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 744 - ENTEL - Department of Network Engineering.

Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Compulsory subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: ALFONSO ROJAS ESPINOSA

Others: Primer quadrimestre:
ALFONSO ROJAS ESPINOSA - 10, 40

PRIOR SKILLS

The course is highly self-contained, although it is very convenient to have knowledge of probability and stochastic processes. Occasionally, it is also convenient to have knowledge of optimization of functions of multiple variables.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:
07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

TEACHING METHODOLOGY

Lectures
Individual work
First part exam and second part exam

LEARNING OBJECTIVES OF THE SUBJECT

The objective of this course is to train the student in the fundamental mechanisms used in data transmission systems, including error control, data compression and cryptographic techniques.

STUDY LOAD

Type	Hours	Percentage
Self study	85,0	56.67
Hours large group	65,0	43.33

Total learning time: 150 h

CONTENTS

1. Introduction. (7h)

Description:
1.1 General scheme
1.2 The concept of information
1.3 Source entropy
1.4 Channel capacity

Full-or-part-time: 13h 48m
Theory classes: 6h
Self study : 7h 48m

2. Source coding (7h)

Description:
2.1 Objectives and limits of lossless compression
2.2 Types of codes
2.3 Kraft's inequality
2.4 Source coding algorithms

Full-or-part-time: 13h 48m
Theory classes: 6h
Self study : 7h 48m

3. Channel coding (24h)

Description:
3.1 Introduction
3..2 Block codes
3.3 Convolutional codes

Full-or-part-time: 46h
Theory classes: 20h
Self study : 26h

4. Basic cryptography (27 h)

Description:
4.1 Introduction
4.2 Security Services
4.3 Classical Cryptography
4.4 Modern Secret Key Cryptography
4.4.1 Stream ciphers
4.4.2 Block ciphers
4.5 Modern Public Key Cryptography
4.5.2 Diffie-Hellman
4.5.3 RSA
4.5.4 Digital Signature

Full-or-part-time: 52h 54m
Theory classes: 23h
Self study : 29h 54m

GRADING SYSTEM

The final grade will include continuous assessment: two exams. The first exam evaluating the one-half of the subject contents and the second exam evaluating the second-half of the subject contents, according to the following criteria:
First part exam: 50%
Second part exam: 50%

BIBLIOGRAPHY

Basic:
- Stallings, W. Network security essentials: applications and standards [on line]. 6th ed. Upper Saddle River, NJ: Pearson Education, 2017 [Consultation: 21/09/2020]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=5186247. ISBN 9781292154916.
- Rifà i Coma, Josep; Huguet i Rotger, Llorenç. Comunicación digital: teoría matemática de la información, codificación algebraica, criptología. Barcelona: Masson, 1991. ISBN 8431105763.
- Kleinrock, Leonard. Queueing systems. New York: John Wiley & Sons, cop. 1975-1976. ISBN 0471491101.
- Aguilar Igartua, Mónica; Forné Muñoz, Jordi; Mata Diaz, Jorge; Rico Novella, Francisco Jose; Espinosa, Alfonso Rojas; Ibáñez, Miguel Soriano. Transmisión de datos: problemas resueltos [on line]. Barcelna: Iniciativa Digital Politècnica, 2010 [Consultation: 06/01/2021]. Available on: https://upcommons.upc.edu/handle/2099.3/36467. ISBN 9788476535141.
- Aguilar Igartua, Mónica; Forné Muñoz, Jordi; Mata Diaz, Jorge; Rico Novella, Francisco Jose; Espinosa, Alfonso Rojas; Ibáñez, Miguel Soriano. Transmissió de dades : problemes resolts [on line]. Barcelona: Iniciativa Digital Politècnica. Oficina de Publicacions Acadèmiques Digitals de la UPC, 2024 [Consultation: 19/06/2024]. Available on: http://hdl.handle.net/2117/410218. ISBN 978841000862.

Complementary:
- Menezes, A.J.; Van Oorschot, P.C.; Vanstone, S.A. Handbook of applied cryptography. Boca Ratón [etc.]: CRC Press, 1997. ISBN 0849385237.