GENERAL INFORMATION

Data of the subject	
Subject name	Switching and Data Transmission
Subject code	DTC-GITT-411
Mainprogram	Bachelor's Degree in Engineering in Telecommunication Technologies
Involved programs	Grado en Ingeniería en Tecnologías de Telecomunicación [Fourth year] Grado en Ingeniería en Tecnologías de Telecom. y Grado en Análisis de Negocios/Business Analytics [Fourth year] Grado en Ingeniería en Tecnologías de Telecom. y Grado en Análisis de Negocios/Business Analytics [Fifth year] Grado en Ingeniería en Tecnologías de Telecomunicación [Fourth year]
Level	Reglada Grado Europeo
Quarter	Semestral
Credits	4,5 ECTS
Type	Obligatoria (Grado)
Department	Department of Telematics and Computer Sciencies
Coordinator	Carlos Javier Monedero Martínez
Schedule	Tuesdays from 8:00 to 8:50 and Fridays from 8:00 to 9:50
Office hours	Please contact the teacher to agree on a date/time.
Course overview	This subject provides the student with the foundation of the Switching and Data Transmission technologies. It gives a view on the evolution of the technology from the early days to present, with focus on the key and valuable concepts and architectural building blocks which will be base for future network designs. Current Transport technologies such as MPLS and WDM are described but also new ones such as SDN are introduced. Those are complemented with a historical overview of mobile telephony systems describing the main characteristics of the 4G and 5G Radio Access Networks. A couple of practical exercises are included to allow students fix key concepts.

Teacher Information	
Teacher	
Name	Carlos Javier Monedero Martínez
Department	Department of Telematics and Computer Sciencies
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DESCRIPTION OF THE SUBJECT

Contextualization of the subject
Prerequisites
Knowledge of Network Technologies and Network Architecture

Course contents

Contents

1. CIRCUIT AND PACKET SWITCHED NETWORKS

- Key concepts
  - Circuit switching and packet switching
  - Routing services
  - Switching centers
  - Circuit switching protocols
- Campus LAN design
- Internal architecture of routers

2. MPLS AND TRAFFIC ENGINEERING

- MPLS: Basic concepts and services
- Architecture of MPLS networks
- MPLS VPNs
- Traffic engineering (RSVP TE)
- Fast Re-route (FRR)
- QoS
- Datacenter networks
- Content delivery networks (CDN)

3. INTRODUCTION TO MOBILE NETWORKS

- Evolution of the mobile telephony systems
- Frequency bands and services
- Mobile telephony system's principles and architecture
- Voice and data technologies
- GSM: Specifications, architecture and dimensioning
- UMTS: WCDMA, architecture and performance
- 4G and 5G: Architecture and components of Radio and Core networks. Frequency bands, OFDMA. Radio resources assignment
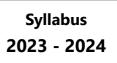
4. MULTILEXING TECHNOLOGIES

- Plesiochronous and Synchronous hierarchy principles (PDH, SDH).
- European Hierarchy (E1), North American hierarchy (T1) and Japanese hierarchy (J1).
- Limitations with PDH and SDH/SONET. WDM technology.

EVALUATION AND CRITERIA

Evaluation activities	Evaluation criteria	Weight
• Intermediate evaluation test (15%) • Final exam (45%)	• Concepts are understood by the student. • Concepts are applied to solve the proposed exercises. • Analysis of the results obtained after solving the proposed exercises.	60 %

• Control Test #1 • Control Test #2	• Concepts are understood by the student. • Concepts are applied to solve the proposed exercises. • Analysis of the results obtained after solving the proposed exercises.	20 %
• Production of reports related to the proposed practical laboratory exercises performed individually or in groups.	• Key concepts are understood by the student. • Integrate and apply the concepts and skills learnt in the course.	20 %

Grading

A minimum grade of 4 over 10 in the final exam (at both, ordinary or extraordinary exams) and in the two practical exercises is required to consider those grades.

A minimum grade of 5 overall is needed to pass the subject. The overall grading of the subject is obtained as follows:

- Final exam 45%
- Intermediate evaluation test 15%
- Practical exercise #1: 10%
- Practical exercise #2: 10%
- Control test #1: 10%
- Control test #2: 10%

In case the student needs to opt for the extra ordinary exam, same criteria than the ordinary exam will apply, keeping the grading obtained in the practical exercises and in the control tests.

BIBLIOGRAPHY AND RESOURCES

Basic References

- Slides prepared by the teacher and presented during the class are stored in Moodle.
- J.M. Huidobro Moya. Telecomunicaciones, tecnologías, redes y servicios. Editorial RA-MA. 2ª edición actualizada. 2015
- R. Giladi, Network Processors: Architecture, Programming and Implementation. Morgan-Kaufmann.
- D. Medhi, K. Ramasamy. Network Routing: Algorithms, Protocols and Architectures. Morgan-Kaufman.

Additional references

- E. Dahlman, S. Parkvall, J. Sköld, 4G LTE / LTE-Advanced for Mobile Broadband. Academic Press, 2nd Edition, 2014