Course guide
230650 - CN - Communication Networks

Last modified: 06/05/2025

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

Degree:	MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Compulsory subject). MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).

Academic year: 2025   **ECTS Credits:** 5.0   **Languages:** English

LECTURER

Coordinating lecturer:	JORDI CASADEMONT SERRA
Others:	Primer quadrimestre: JORDI CASADEMONT SERRA - 10 XAVIER HESSELBACH SERRA - 10

PRIOR SKILLS

- Packet switched networks: datagram and virtual circuit oriented.
- Concepts as throughput, network efficiency and occupancy.
- Error control and compression mechanisms. Source coding. Channel coding.
- Medium Access Control algorithms: Aloha, CSMA-CD, CSMA-CA.
- Local Area Networks: Ethernet (hubs, switches, switching tables, spanning tree protocol, VLANs, flow control, autoconfiguration, implementations).
- Communication protocols: IPv4 (fragmentation, subnetting, supernetting, routing tables), ICMPv4, ARP, TCP (sliding window mechanism, flow and congestion algorithms), UDP, HTTP, DNS.
- Markov chains modelling. Queuing systems (Erlang-B, Erlang-C).
- To be familiarized with communication protocols analizers: wireshark.
- Linux: medium level for operating system operation and advanced level on network interfaces configuration.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Ability to deal with the convergence, interoperability and design of heterogeneous networks with local, access and core networks, as well as with service integration (telephony, data, television and interactive services).
2. Ability to design and dimension transport, broadcast and distribution networks for multimedia signals
3. Ability to model, design, implement, manage, operate, administrate and maintain networks, services and contents
4. Ability to plan networks and decision-making about services and applications taking into account: quality of service, operational and direct costs, implementation plan, supervision, security processes, scalability and maintenance. Ability to manage and assure the quality during the development process
5. Ability to understand and to know how to apply the functioning and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services

Transversal:
6. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

7. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

- Lectures.
- Application classes.
- Individual work.
- Exercises.

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives of the subject:

The aim of this course is to train students in access and core network technologies, both wired and wireless and understand the functioning and organization of the new generation Internet technologies, protocols, component models and services.

Learning results of the subject:

- Ability to specify, design networks, services, processes and applications of telecommunications in both fixed and mobile environments, personal, local or long distance, with different bandwidths, in multicast networks, including voice and data.
- Ability to apply both traffic engineering as planning tools, dimensioning and network analysis.
- Ability to analyse, model and implement new architectures, network protocols, communication interfaces and new network services and applications.
- Ability to implement and design the convergence and interoperability of heterogeneous networks considering local, access and core networks.

STUDY LOAD

Type	Hours	Percentage
Self study	86,0	68.80
Hours large group	39,0	31.20

Total learning time: 125 h

CONTENTS

1. Wireless local area networks

Description:
EEE802.11 standard including versions, physical layer, MAC layer and access schemes (PCF and OFDMA), quality of service, power management, fairness and performance analysis

Full-or-part-time: 33h
Theory classes: 12h
Self study : 21h

2. Other Wireless Networks

Description:
Low-Rate Wireless Personal Networks: Wireless Sensor Networks, IEEE 802.15.4, ZigBee, 6LowPAN
Vehicular networks (VANETs): ETSI ITS (Intelligent Transport Systems) architecture

Full-or-part-time: 10h
Theory classes: 4h
Self study : 6h

3. IPv6

Description:
IPv6, ICMPv6, autoconfiguration

Full-or-part-time: 10h
Theory classes: 4h
Self study : 6h

4. Routing

Description:
Routing algorithms
Interior Gateway Protocols: RIP, OSPF
Exterior Gateway Protocols: BGP4
Routing in MANET

Full-or-part-time: 10h
Theory classes: 4h
Self study : 6h

5. Network virtualization

Description:
Concepts and definitions
Modelling
Virtual Network Embedding
Metrics
Online and Online

Full-or-part-time: 12h
Theory classes: 4h
Self study : 8h

6. Network optimization

Description:
Network modelling: Notation, metrics
Optimization

Full-or-part-time: 9h
Theory classes: 3h
Self study : 6h

7. Core networks

Description:
Basic concepts: Classification, traffic aggregation, service categories, QoS, control strategies, fair resources allocation. MPLS and SDN networks: Motivation, architecture, SDN controller, OpenFlow.

Full-or-part-time: 18h
Theory classes: 6h
Self study : 12h

8. Fixed access networks

Description:
Basic concepts. Optical fiber access netrworks. Classification. GPON standard. Other access networks.

Full-or-part-time: 6h
Theory classes: 2h
Self study : 4h

Final test

Description:
Final test

Full-or-part-time: 17h
Theory classes: 2h 30m
Self study : 14h 30m

GRADING SYSTEM

Final examination: 60%.
Individual assessments: 40%.

BIBLIOGRAPHY

Basic:
- Davies, J. Understanding IPv6. 3rd ed. Redmond, Wash: Microsoft Press, 2008. ISBN 9780735624467.
- Perros, H.G. Connection-oriented networks: SONET/SDH, ATM, MPLS, and optical networks. Hoboken: John Wiley, 2005. ISBN 0470021632.
- Comer, D.E. Internetworking with TCP/IP: vol.1: principles, protocols and architecture. 6th ed. Upper Saddle River: Prentice-Hall International, 2014. ISBN 9780136085300 (V.1).
- Doherty, Jim. SDN and NFV simplified : a visual guide to understanding software defined networks and network function virtualization. [Upper Saddle River, NJ]: Pearson Education, [march 2016]. ISBN 978-0134306407.

Complementary:
- Perahia, E.; Stacey, R. Next generation wireless LANs: throughput, robustness, and reliability in 802. 11n, 802. 11ac [on line]. 2nd ed. Cambridge University Press, 2013 [Consultation: 20/06/2017]. Available on: http://site.ebrary.com/lib/upcatalunya/docDetail.action?docID=10718563. ISBN 9781107347793.
- Gómez, C.; Paradells, J.; Caballero, J.E. Sensors everywhere: wireless network technologies and solutions. [s.l.]: Fundación Vodafone España, 2010. ISBN 9788493474058.
- Pavón Mariño, Pablo. Optimization of computer networks : modeling and algorithms : a hands-on approach [on line]. Chichester, West Sussex, United Kingdom: John Wiley & Sons, Inc, 2016 [Consultation: 13/06/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=4462524. ISBN 9781119013358.
- Pujolle, G. Software networks : virtualization, SDN, 5G and security [on line]. London : Hoboken: ISTE ; Wiley, 2015 [Consultation: 23/06/2022]. Available on: https://onlinelibrary.wiley.com/doi/book/10.1002/9781119694748. ISBN 9781848216945.
- Zhang, Ying. Network function virtualization: concepts and applicability in 5G networks [on line]. Hoboken, New Jersey: John Wiley & Sons, 2018 [Consultation: 13/06/2022]. Available on: https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9781119390633. ISBN 9781119390626.