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230650 - CN - Communication Networks

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 744 - ENTEL - Department of Network Engineering

Academic year: 2019

Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Compulsory)
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Teaching unit Optional)
MASTER'S DEGREE IN INFORMATION AND COMMUNICATION TECHNOLOGIES (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: JORDI CASADEMONT

Others: A. CALVERAS, X. HESSELBACH, J. PARADELLS

Requirements

It is required to know:
- 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.

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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

Total learning time: 125h	Hours large group:	39h	31.20%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	0h	0.00%
	Self study:	86h	68.80%

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Content

1. Wireless local area networks

Learning time: 32h
Theory classes: 12h
Self study : 20h

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

2. Low-Rate Wireless Personal Networks

Learning time: 9h
Theory classes: 3h
Self study : 6h

Description:
- IEEE 802.15.4, ZigBee, 6LowPAN and Wireless Sensor Networks.

3. Network level: IPv6 and routing

Learning time: 27h
Theory classes: 10h
Self study : 17h

Description:
- Global routing and routing within Internet provider's domain:
  - Algorithms: Distance Vector, Link State.
  - Protocols: RIP, OSPF, BGP.
- IPv6, ICMPv6, autoconfiguration, migration.

4. Fixed access networks

Learning time: 6h
Theory classes: 2h
Self study : 4h

Description:
- Cooper and optical fibre digital distribution networks: xDSL, FTTX.

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5. Core networks	Learning time: 18h Theory classes: 6h Self study : 12h

Description:
- Digital Hierarchies PDH and SDH: Definitions, frame format and hierarchies, SDH mapping.
- Core networks fundamentals: Service categories, control mechanisms, fairness, fair bandwidth allocation.
- MPLS networks.
- SDN networks: motivation, SDN architecture, the controller, OpenFlow controller.

6. Network optimization	Learning time: 12h Theory classes: 4h Self study : 8h

Description:
Network modeling: Notation, metrics.
Optimization: Linear and non-linear programming, complexity.

Mid term test	Learning time: 10h Theory classes: 2h Self study : 8h

Description:
Mid term test.

Final test	Learning time: 11h Theory classes: 3h Self study : 8h

Description:
Final test.

Qualification system

Final examination: 40%.
Partial examinations and controls: 40%.
Individual assessments: 20%.

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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).

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.

Kozierok, C. The TCP/IP guide: a comprehensive, illustrated internet protocols reference. San Francisco: No Starch Press, 2005. ISBN 159327047X.