

230015 - IXT - Introduction to Networks

Coordinating unit:	230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit:	744 - ENTEL - Department of Network Engineering
Academic year:	2019
Degree:	BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Compulsory) BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory) BACHELOR'S DEGREE IN ELECTRONIC SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory) BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Teaching unit Compulsory) BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory) BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits:	6
Teaching languages:	Catalan, Spanish

Teaching staff

Coordinator:	MÓNICA AGUILAR IGARTUA ISRAEL MARTÍN ESCALONA ISABEL VICTORIA MARTÍN FAUS
Others:	MONICA AGUILAR IGARTUA FRANCISCO BARCELÓ ARROYO ANNA CALVERAS AUGÉ JORDI CASADEMONT SERRA LUIS JAVIER DE LA CRUZ LLOPIS XAVIER HESSELBACH SERRA ISABEL MARTÍN FAUS ISRAEL MARTÍN ESCALONA ESTEVE PALLARÈS SEGARRA MARCOS POSTIGO BOIX ALFONSO ROJAS ESPINOSA JOAN SERRAT FERNÁNDEZ

Degree competences to which the subject contributes

Generical:

6. ABILITY TO IDENTIFY, FORMULATE AND SOLVE ENGINEERING PROBLEMS Level 3. To identify and model complex systems. To identify methods and tools appropriate to pose the equations and descriptions associated with the models and to solve them. To carry out qualitative analysis and approaches. To determine the uncertainty of the results. To formulate hypotheses and experimental methods to validate them. To set up and manage undertakings. To identify major components and establish priorities. To develop critical thinking.
7. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.
- 12 CPE N1. They will be able to identify, formulate and solve engineering problems in the ICC field and will know how to develop a method for analysing and solving problems that is systematic, critical and creative.

Transversal:

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1. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
3. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
4. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
5. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Teaching methodology

Application classes
Lectures
Laboratory classes
Individual work (not presential)
Short-answer tests (Control)
Short-answer tests (Test)
Extended-response tests (Final Exam)
Laboratory

Learning objectives of the subject

The objective of this course is to introduce students to the basic concepts of data communications networks. Basic knowledge about the structure of circuit-switched and packet switched networks. It introduces the most relevant communication protocols operating in communications networks, the main characteristics of access networks, transport and wireless networks. Students will know the main techniques for error recovery and for shared medium access, as well as the mechanisms to interconnect heterogeneous networks and the basic routing algorithms.

Learning outcome:

Knowledge and use of the concepts of network architecture, communication protocols and interfaces.
Understanding of the differences between access and transport networks, circuit-switched networks, packet-switched networks and mobile networks. Students will know and will analyse networking methods and routing operation.

Students will plan and carry out oral presentations, respond to the questions asked and write properly basic-level texts.

Identify the group's objectives and capability to design a working plan to achieve them. Identify the responsibilities of each member of the group and fulfilment of the objectives of the assignment.

Perform the tasks on schedule, according to the guidelines set by the teacher or tutor. Identify the degree of progress and achievement of the objectives of learning.

Use of resources and available services to run simple searches. Classify and summarize the information collected and properly cite sources.

Raise the problem correctly from the proposed statement and identify options for resolution. Apply the appropriate resolution method and identify the correction of the solution.

Knowledge and use of correct tools, software tools and applications available in the laboratories and carry out correctly the analyse of the collected data.



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Study load

Total learning time: 150h	Hours large group:	39h	26.00%
	Hours small group:	26h	17.33%
	Self study:	85h	56.67%

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Content

<p>1. Introduction to telematic networks.</p>	<p>Learning time: 43h Theory classes: 11h Practical classes: 0h Laboratory classes: 6h Self study : 26h</p>
<p>Description: The main networks and telematic services are introduced. Network classification: acces network and transport network. Channel sharing between multiple users (multiplexing). Deterministic and statistical time division multiplexing. Network classification on basis of the switching technique. Circuit switching and packet switching (datagram and virtual circuit). Basic metrics for the channel utilization and the protocol efficiency. Main network architectures: TCP/IP and the OSI reference model.</p> <p>Laboratory session: Configuration and analysis of asynchronous serial communications.</p>	
<p>2. Data link.</p>	<p>Learning time: 20h 30m Theory classes: 5h 30m Practical classes: 0h Laboratory classes: 2h Self study : 13h</p>
<p>Description: Data link reliability. Flow and error control. Error detection and correction mechanisms, by means of automatic retransmission request (ARQ) or forward error correction (FEC). Analysis of different ARQ modes (Stop&Wait, Go-Back N, Selective repeat).</p> <p>The more common techniques used for the access to shared mediums are also introduced. Contentionless (TDMA, polling, token ring) and contention techniques (Aloha, slotted-Aloha, CSMA, CSMA/CD, CSMA/CA). Two laboratory sessions: Serial communications using a simple data communication protocol and HDLC (High-level Data Link Control) protocol.</p>	

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<p>3. Local Area Networks.</p>	<p>Learning time: 32h 30m</p> <p>Theory classes: 8h 30m Practical classes: 0h Laboratory classes: 4h Self study : 20h</p>
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Description:

The most common local area network technologies are studied: Ethernet and IEEE 802.11 networks (WiFi).

Characteristics and interconnection of Ethernet networks by means of repeaters, hubs and switches. Basic characteristics of wireless networks, frame types and procedures.

Laboratory session: Ethernet local area networks.

<p>4. Network interconnection.</p>	<p>Learning time: 38h</p> <p>Theory classes: 8h Practical classes: 0h Laboratory classes: 10h Self study : 20h</p>
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Description:

Internet protocol (IP), addressing, datagrams fragmentation and reassembly.

Subnetting and supernetting.

Address Resolution Protocol (ARP).

Internet Control Messages Protocol (ICMP).

Introduction to multicast transmissions.

Metric concept and routing tables. Main dynamic and static routing mechanisms.

Introduction to transport layer protocols (UDP and TCP).

Dynamic Host Configuration Protocol (DHCP).

Domain Name System (DNS).

Laboratory sessions: Different sessions about IP networks working on LINUX stations. Several protocols are studied in detail (IP, ARP, ICMP). Routing tables and an introduction to dynamic routing protocols are also covered.

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Planning of activities

LABORATORY SESSION 1. INTRODUCTION TO LINUX.

Description:

First laboratory session about Linux. Students will learn the essentials of this operating system in order to be able to do the rest of the laboratory sessions.

Descriptions of the assignments due and their relation to the assessment:

Previous study. It must be made before the laboratory session. It is an essential requirement to perform the session and therefore to be evaluated.

LABORATORY SESSION 2. SERIAL COMMUNICATIONS.

Description:

Configuration and analysis of asynchronous serial communications. The study of a simple data link protocol is included.

Descriptions of the assignments due and their relation to the assessment:

Previous study. It must be made before the laboratory session. It is an essential requirement to perform the session and therefore to be evaluated.

LABORATORY SESSION 3. HDLC PROTOCOL.

Description:

High-level Data Link Control protocol configuration and analysis. The study is focused on the flow and error control mechanisms.

Descriptions of the assignments due and their relation to the assessment:

Previous study. It must be made before the laboratory session. It is an essential requirement to perform the session and therefore to be evaluated.

LABORATORY SESSION 4. ETHERNET LOCAL AREA NETWORKS.

Description:

Physical and data link layers study of a switched Ethernet network. The session includes the study of the selfconfiguration mechanism and the line code, by means of scope captures.

Descriptions of the assignments due and their relation to the assessment:

Previous study. It must be made before the laboratory session. It is an essential requirement to perform the session and therefore to be evaluated.

FIRST LABORATORY MIDTERM CONTROL.

Description:

Midterm control to be done individually by the students in the laboratory.

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FIRST CONTROL OF THEORY	Hours: 1h Theory classes: 1h
<p>Description: Control of the 1st part of the theory, to be done individually by the students.</p>	
SECOND LABORATORY MIDTERM CONTROL.	
<p>Description: Midterm control to be done individually by the students in the laboratory.</p>	
LABORATORY SESSION 5. IP NETWORKS.	
<p>Description: By means of virtualization over Linux workstations, all the functionalities of the IP layer are studied in detail. A first study of dynamic routing protocols is also included.</p> <p>Descriptions of the assignments due and their relation to the assessment: Previous study. It must be made before the laboratory session. It is an essential requirement to perform the session and therefore to be evaluated.</p>	
SECOND CONTROL OF THEORY	Hours: 1h Theory classes: 1h
<p>Description: Control of the 2nd part of the theory, to be done individually by the students.</p>	
EXTRAORDINARY EXAM	Hours: 2h Theory classes: 2h
<p>Description: Extraordinary exam of the theory part to be done individually by the students in case of not passing the course (the student failed in the continuous evaluation). This exam will be hold during the weeks planned by the ETSETB for extraordinary exams (in July).</p>	

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Qualification system

1 - This course has evaluation of theory and of laboratory.

- The theory part is approved by continuous assessment. The theory mark consists of two controls with a weight of 50% each.

- The laboratory mark consists of two controls with a weight of 50% each.

2 - The grade for the course is 70% of theory mark and 30% of laboratory mark.

- If the course is approved, the evaluation process is completed.

- If the course is failed and you fulfil the ETSETB conditions about extra exams, you can go to an EXTRA exam of the theory part hold during the planned term (July). In this case, the grade for the course is 70% of the EXTRA mark and 30% of laboratory mark (the mark obtains in the normal evaluation period).

- The extraordinary exam of the theory part will be done individually by the students in case of not passing the course (the student failed in the continuous evaluation). This exam will be hold during the weeks planned by the ETSETB for extraordinary exams (in July).

3 - Laboratory attendance is compulsory.

This course evaluates this generic skill:

- Ability to identify, formulate and solve engineering problems (Level). For the evaluation, the grades obtained in the different tests and exams done during the semester, in which engineering problems appear, are taken into account.

Bibliography

Basic:

Forouzan, B.A. Data communications and networking. 5th ed. New York: McGraw-Hill, 2013. ISBN 0071254420.

Complementary:

Kleinrock, L. Queueing systems: vol 1: theory. New York: John Wiley & Sons, 1975. ISBN 0471491101 (V. 1).