Advanced Internet Technologies

Degree	Type	Year	Semester
2502441 Computer Engineering	OB	3	2
2502441 Computer Engineering	OT	4	2

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

Teachers

Carlos Borrego Iglesias

Prerequisites

The course does not have any official prerequisite, but it is recommended to have previously coursed the "Computer Networks" course, or to have the equivalent knowledge (basic protocols of the TCP / IP family).

Objectives and Contextualisation

This is the second course on the subject "Communication Technologies". Once you have seen the most physical aspects of the networks, and of their configuration and management, we will see more advanced aspects of the networks. The course will focus on the networks that use the family of TCP / IP protocols for their interconnection.

The training objectives of the course are focused on obtaining a specific knowledge of advanced concepts related to the interconnection of internet networks, such as those that allow tuning protocol parameters to obtain good performances in particular scenarios, and obtain a more general view of these networks through multi-level architectures. Knowing in depth the new version of the IP protocol, IPv6, will be another objective of the subject.

On the other hand, the students will have to be able to design networks, and configure them, to adapt to particular requirements. They should also be capable of detecting and solving performance problems in a network, and configuring routers with load balancing, following specific queue management policies, and translating NAT addresses.

Competences

Computer Engineering
- Acquire personal work habits.
- Acquire thinking habits.
- Capacity to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as of the information that they manage.
- Conceive and develop centralised or distributed computer systems or architectures by integrating hardware, software and networks.
- Have the capacity to define, evaluate and select hardware and software platforms for the development and execution of computer systems, services and applications.
- Have the capacity to select, design, deploy, integrate, evaluate, build, manage, exploit and maintain hardware, software and network technologies within the suitable parameters of cost and quality.
- Have the right personal attitude.

Learning Outcomes

1. Be able to configure and exploit the possibilities of different types of telematic network.
2. Design and evaluate an integrated information technologies and communications.
3. Develop a mode of thought and critical reasoning.
4. Develop curiosity and creativity.
5. Know and understand the protocols and equipment in major architectures and communications networks .
6. Manage time and resources available. Work in an organized manner .
7. Prevent and solve problems.
8. Properly integrate communications networks and web services in the same system.
9. know the information technology and communication apply it to meet business needs.

Content

Unit 1. The TCP Protocol in depth

- Timeouts and retransmissions
- Congestion control
- Window control
- Performance and improvements

Unit 2. Interconnection of Private Networks

- Virtual Private Networks
- Multilevel internet architectures
- Translation of network addresses

Unit 3. Multicast on the Internet

- Addressing
- Notification and delivery
- Routing

Unit 4. Distributed network architectures

- Introduction to distributed network architectures
- P2p networks

Unit 5. Internet Protocol version 6 (IPv6)

- Addressing
- Routing
- Self-configuration

Unit 6. Internet security

- IPsec
- DNSsec
- SSH tunnels
- NameCoin
- Anonymous networks: TOR

Methodology

Throughout the course, the following activities will be carried out:

Theoretical sessions, where the teacher will guide students towards the acquisition of knowledge about the subject and strategies to expand, organize and take advantage of this knowledge. The active participation of the students during these sessions will be encouraged, for example, discussions in those points that support different technological solutions.

Problem sessions, where students must participate actively to consolidate the acquired knowledge by solving, presenting and debating problems that are related to them. We distinguish the problems from the exercises, which could be considered trivial problems. Problems will often support various solutions and may lead to a debate among students. The seminars will need to be prepared previously by the students (solving the problems) and by the teacher (designing strategies of debate based on the different approaches proposed by the students).

Laboratory sessions, where small projects will be considered to be analyzed and developed by the students in groups of three people. The sessions will be prepared, documented and programmed by the teacher in advance and the students will have to prepare them before attending, reviewing the theoretical knowledge related and the basic technical aspects of the development. The practical sessions should serve the students to achieve the skills of the subject and contribute to the achievement of some competences such as teamwork, or the ability to analyze and synthesise.

Preparation of problems related to the theory sessions and to be discussed in the sessions of problems, as an activity continued throughout the course.

Cross-cutting competences. Evaluation and work methodology:

T01.01 - Develop a way of thinking and criticalreasoning. It will work using questions asked by the teacher. The evaluation will be through the half-year control and the final test of validation.

T02.03 - Manage time and resources available. Work in an organized manner. To work on this competence, the Flipped Classroom technique will be used. The evaluation will be through the half-year control and the final test of validation.

T02.04 - Preventing and solving problems. The evaluation will be through the half-year control and the final test of validation.

T06.02 - Develop curiosity and creativity. The evaluation will be through the half-year control, the final test of validation and mainly the activities.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory sessions	12	0.48	9, 2, 8, 1
Problem lectures	12	0.48	9, 2, 8, 7
Theory lectures	26	1.04	5, 9, 4, 2, 7
Type: Supervised			
Supervised class activities	8	0.32	5, 4, 2, 1
Type: Autonomous			
Laboratory work and autonomous work	23	0.92	9, 2, 8, 1
Probem resolution	30	1.2	5, 9, 2, 8, 7, 1
Study and preparation for the validation tests	30	1.2	5, 9, 2, 8, 1

Assessment

Evaluation criteria

The evaluation will be continuous and formative based on the learning evidences generated by the students in the elaboration of the class activities, the mid-term control and the final validation exam and the reports of development of the laboratoty sessions.

Activities and instruments that will be used to evaluate:

Activities

They are non-recoverable activities that take place within or outside the theory and problem sessions, without regular regularity. They are not compulsory (they do not have to be done to pass the subject). Examples of these activities can be: a commentary on a documentary seen at class, homework assignments, the description of a theatrical activity done in class, a small and brief test of two questions about the theory session or problems.

Mid-course control and final examinations of validation of knowledge and laboratory sessions

The mid-term control is a non-recoverable individual written test that aims to validate if each student has achieved the minimum knowledge of the subject worked up to that moment. It does not eliminate content for the final exam and it does not have a minimum mark for this test.

The final exam and laboratory tests are individual written tests that aim to validate if each student has achieved

in a minimum way the global knowledge and the abilities of the subject. These exams are motivated by the high importance given to the correct achievement of the knowledge and skills of the subjects. The final validation test is mandatory for every student. The laboratory examination is mandatory for everyone who does not demonstrate the achievement of the practices in the corresponding evaluation sessions that follow each project.

A retake exam of the final exam is planned for those students who have not passed it on the first opportunity.

Laboratory sessions

The laboratory sessions consist in the accomplishment of a series of projects with which they are tried to acquire knowledge and skills seen in theory or totally new ones. It is equally important to have worked in all the development of these sessions, such as having understood and learned the knowledge that is derived from it. The attendance of the practical sessions is compulsory.

Indicators that will be used to qualify the learning achieved

We will value that the resolutions of the activities proposed in class are well argued and corrected if appropriate. We will value the participation of the students and the reports or documents delivered. In the practical part, we will use as indicators the preparation and the active participation in the sessions of laboratory and in the session of evaluation and the quality in the elaboration of the reports. In the mid-term test and in the final exam and the validation of laboratory sessions the main indication will be the degree of correction of the answers to the questions raised.

Note about copies, plagiarism and other irregularities

Notwithstanding other disciplinary measures deemed appropriate, and in accordance with the current academic regulations, irregularities committed by a student that may lead to a variation of the qualification will be classified by zero (0). Assessment activities qualified in this way and by this procedure will not be recoverable. If it is necessary to pass any of these assessment activities to pass the course, this subject will be suspended directly, without opportunity to recover it inthe same course. These irregularities include, among others:

- the total or partial copy of a practice, report, or any other evaluation activity;
- allow to be copied;
- to present a group work that has not be entirely done by the members of the group;
- present as own materials prepared by a third party, even if they are translations or adaptations;
- to have communication devices (such as mobile phones, smart watches, etc.) accessible during the theoretical-practical exams.

If the student does not pass the subject due to the fact that none of the evaluation activities do not reach the minimum grade required, the numerical mark of the student record will be the lowest value between 4.5 and the weighted average of the notes. With the exceptions that the "non-evaluable" qualification will be awarded to students who do not participate in any of the assessment activities, and that the numerical note of the record will be the lowest value between 3.0 and the weighted average of the notes in case the student has committed irregularities in an evaluation act (and therefore it will not be possible to approve it for compensation).

Course assesment

The final grade of the subject, which includes assessment on the acquisition of knowledge, skills and competencies, will be calculatedbyweighting:

- 35% of the qualification by means of the final exam. The minimum mark required by this part is 5 out of 10.

- 35% of the qualification by means of the final grade of the laboratory part, calculated from the weighted average of the qualifications of each project. At least a 5 out of 10 must be obtained in each project. The minimum grade required by this part is 5 out of 10 and the laboratory validation exam is evaluated with Pass / Fail mark.
- 15% of the qualification by means of the mid-term exam. No minimum mark is required for this part.
- 15% of the qualification by means of the grade of the activities. No minimum mark is required forthis part.

The final grade of 15% corresponding to the mid-year control, MC, will be calculated based on the mark obtained in the final exam. If the MC grade is equal to or greater than 1.5 and the final exam score is equal to or greater than 5, then it will be taken as MC, the maximum between 5 and its value. This is due to the fact that the final exam evaluates all the theoretical content of the subject.

Granting an honorific matriculation qualification is a decision of the faculty responsible for the subject. The regulations of the UAB indicate that passing the course with honours can only be awarded to students who have obtained a final grade of 9.00 or more. It can only be granted up to 5% of the total number of students enrolled.

There will be no automatic validation. Validations must be requested explicitly following the procedure that will be indicated on the first day of class. There is no differentiated treatment for repeating students.

All important dates and information of the course, such as examination's dates or laboratory projects information and delivery dates, will be published in the Campus Virtual.

Single assessment

In this course, students cannotbenefit from a single assessment.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Activities	15% (no minimum mark required)	3	0.12	5, 9, 4, 3, 2, 6, 8, 7, 1
Final knowledge validation test	35% (minimum: 5 out of 10)	2	0.08	5, 9, 3, 2, 6, 8, 7, 1
Half-term knowledge validation test	15%. (no minimum mark required)	1	0.04	5, 4, 3, 2, 6, 8, 7, 1
Lab sessions monitoring and possible validation test	35% (mínimum: 5 out of 10)	3	0.12	9, 2, 8, 1

Bibliography

Basic bibliography

1. D.E. Comer (2005). Internetworking with TCP/IP, 5th Edition. Prentice Hall.

Complementary bibliography

1. W. R. Stevens (1993). TCP/IP Illustrated, Volume I, Addison-Wesley.

2. A.S. Tanenbaum (2002). Computer Networks, 4th Edition. Prentice Hall.
3. W. Stallings (2011). Data and Computer Communications, 9a Edición. Pearson Prentice Hall.

Software

- The ONE The Opportunistic Network Environment simulator https://akeranen.github.io/the-one/