

Networks

Code: 102746
ECTS Credits: 6

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Degree	Type	Year
2502441 Computer Engineering	OB	2

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Teaching groups languages

You can view this information at the [end](#) of this document.

Prerequisites

There are no prerequisites. However, students should be familiar with the most basic concepts of Operating Systems. It is also recommended for students to have taken the courses on basic programming.

Objectives and Contextualisation

This is the second course of the subject "Operating Systems and Computer Networks", where the concepts about the operation of TCP/IP based networks (and Internet in particular) are shown, both from the point of view of the network interconnection and from the perspective of the relationship between end computers and applications providing services to users.

The formative objectives of the course are, on the one hand, that students get a general vision of the concepts related to computer networks and with the interconnection of heterogeneous networks; that they thoughtfully know the issues and protocols related with the joint operation of heterogeneous systems over a set of interconnected networks and the main distributed application in these systems, with a notion of their development. On the other hand, students have to be able to design extensible and robust internet networks, to configure connections to internet networks, and to detect and solve network problems due to misconfigurations or protocol attacks.

Competences

- Acquire personal work habits.
- Capacity to design, develop, select and evaluate computer applications and systems, ensuring reliability, security and quality, in accordance with ethical principles, and applicable standards and legislation.
- Conceive and develop centralised or distributed computer systems or architectures by integrating hardware, software and networks.
- Know and apply the basic and main techniques of parallel, concurrent, distributed and real time programming.
- Know and apply the functional and structural characteristics of distributed systems and computer and Internet networks, and design and implement applications based on these.
- Know the characteristics, functionalities and structure of operating systems and design and implement applications based on their services.

Learning Outcomes

1. Analyse the main protocols and know about the international standards and standardisation bodies.
2. Create thread and socket based applications, including mutex primitives and condition-type variables.
3. Design, develop, select and evaluate computer systems, ensuring their reliability, security and quality.
4. Know and apply the basic and main techniques of concurrent and distributed programming.
5. Know and apply the characteristics, functionalities and structure of distributed hardware systems and computer networks to design and implement applications based on the same.
6. Know and understand the concepts related to computer networks , knowing to place them in a hierarchical system protocols .
7. Know how to administer and maintain computer systems, services and applications in terms of the base software.
8. Know the details of local and wide area networks and how they operate.
9. Manage time and resources available. Work in an organized manner .
10. Understand the essential mechanisms of data transmission.
11. Work independently.

Content

Unit 1. Introduction

- Computer networks and network of networks
- The TCP/IP protocol family
- Basic networks typologies and technologies

Unit 2. Netork interconnection protocols

- Principles of network interconnection
- Addressing
- Local address resolution
- IP protocol
- Basic routing
- ICMP Protocol

Unit 3. End-to-end protocols

- Principles of end-to-end communications
- User Datagram Protocol UDP
- Reliable byte stream protocol TCP

Unit 4. Apploication protocols

- Principles of TCP/IP applications
- Application access to lower layers. Socket of Berkeley interface
- Domain Name System DNS
- Configuration Protocol DHCP

Unit 5. Advanced protocols for network interconnections

- Internet architecture
- Autonomous Systems and Neutral Points
- Routing protocols within Autonomous Systems (RIP, OSPF)
- Routing protocols between Autonomous System (BGP)

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory sessions	12	0.48	2, 3, 4, 5, 7, 9, 11
Problem resolution sessions	12	0.48	1, 3, 4, 6, 8, 10
Theory classes	26	1.04	1, 3, 4, 6, 8, 10
Type: Supervised			
Supervised activities proposed in class	8	0.32	1, 4, 6, 8, 10
Type: Autonomous			
Course problems writing	30	1.2	1, 8, 9, 10, 11
Preparation and autonomous work for the laboratory sessions	24	0.96	2, 3, 4, 5, 7, 9, 11
Study and preparation for the assessment tests	30	1.2	1, 3, 4, 5, 6, 7, 8, 9, 10, 11

These activities will be carried out during the course:

- Lectures (theory sessions), where the teacher will provide information about the knowledge of the course and about strategies to obtain, extend, and organise this knowledge. Student active participation will be encouraged during these sessions, for example by proposing a debate where multiple technological approaches are accepted.
- Problem solving sessions, where students will have to actively participate to consolidate their knowledge by resolving, presenting and debating related problems.
- Laboratory practical sessions, where small projects are proposed to be analysed and developed by groups of two students. These sessions will be prepared, documented, and programmed by the teacher beforehand, and students will have to prepare them before attending to the lab, reviewing theory technological aspects about the development.
- Resolution of problems related to the theory sessions to be discussed during the problem resolution sessions, as a continuous activity during the course.
- Several supervised activities proposed by the teachers during the course to consolidate the knowledge on the subject and to explore its practical application.

There will be no differentiated treatment for students who retake the course.

The UAB virtual platform (Campus Virtual, <https://cv.uab.cat/>) will be used for communication between teachers and students, and between students. It will be also used to deliver activities and accessing working documents of the course.

Transverse competences worked in this course are T02.01 Autonomous work, and T02.03 Time and available resource management. Working in an organised way. These competences are worked in different parts of the course, such in the resolution of problems, or in the laboratory sessions.

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.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Activities	10%. No minimum mark is required for this part	2	0.08	1, 6, 7, 8, 9, 10
Final validation test	35%. The minimum grade required by this part is 5 out of 10	2	0.08	1, 4, 6, 8, 9, 10, 11
Knowledge and skill controls	15%. No minimum mark is required for this part	0.5	0.02	1, 6, 8, 9, 11
Practical case	5%. No minimum mark is required for this part	0.5	0.02	1, 6, 8, 9, 11
Practical laboratory session follow up, with the possibility of undertaking a validation test	35%. The minimum mark required by this part is 5 out of 10	3	0.12	2, 3, 5, 9, 11

Assessment criteria

The assesment of the course is continuous and formative, using a number of learning evidences generated by students along the course.

Activities and instruments for the assessment:

Class activities

These activities are carried out during the classe or via the Campus Virtual, without any regularity. These activities are not compulsory (they do not need to be done to pass the subject, although they are part of the assessment). Examples of these activities can be: a commentary on a short documentary passed in class, the description of a theatrical activity done in class, some test questions about the theory session or newly created problems, analyze the functioning of the classroom, a protocol for the exchange of routing information, etc.

Controls and final validation examinations of knowledge

The controls of knowledge and skills are individual written tests that aims to validate if each student has achieved the minimum knowledge of the subject worked up to that moment. They do not eliminate matter for the final exam nor a minimal note is required for these controls. The final examinations of validation of knowledge and practices 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 successful achievement of the knowledge and skills of the subjects in the engineering environment where the degree is framed. The final examination of knowledge validation is mandatory for all students.

Practical case

There will be a small test in which the student will solve individually a practical case, applying the competences acquired during the course. In this exercise, it is valid as the student has integrated what he has learned in order to solve a plausible case that could be found, for example, in their professional future.

Laboratory projects

The practical lab projects consist in the accomplishment of a series of projects with which they try to obtain knowledge and abilities related to the subject. It is equally important to have worked in all the development of the practice, such as having understood and learned the knowledge that is derived from it. The specific details on the organization of the labs (projects, groups, calendar, weighting ...) and on their follow-up (reports, assistance requirements, code of originality policy ...) can be downloaded from Virtual Campus Attendance at practice sessions (closed laboratory) is mandatory. To be evaluated it will be essential to have assisted at least 80% of the laboratory sessions. To pass this part of the evaluation each lab project has to be passed.

Indicators that will be used to qualify the learning achieved

In the problems and supervised work the indicators that we will use will be the individual record in the work, the cooperation between the members of each team, the quality of the work done and the degree of participation in the set of evidences. Quality indicators are the correct use of the technical terms, the correct wording of the paragraphs, and the good structure of the contents delivered. We will also value the certainty in the work. We will value that the resolutions of the problems are well argued and corrected if applicable. In class activities, 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 (previous reports) and active participation in the sessions of practices and in the session of evaluation and the quality in the elaboration of the reports of complete development. In the controls and in the final examinations of validation of knowledge and validation of practices the main indication will be the degree of correction of the answers to the questions raised.

Remarks about copying, plagiarism and cheating

Notwithstanding other disciplinary measures deemed appropriate, and in accordance with the academic regulations in force, assessment activities will receive a zero (0) whenever a student commits academic irregularities that may alter such assessment. Assessment activities graded in this way and by this procedure will not be re-assessable. If passing the assessment activity or activities in question is required to pass the subject, the awarding of a zero (0) for disciplinary measures will also entail a direct fail for the subject, with no opportunity to re-assess this in the same academic year. Irregularities contemplated in this procedure include, among others:

- the total or partial copying of a practical exercise, report, or any other evaluation activity;
- allowing others to copy;
- presenting group work (from the current or previous years) that has not been done entirely by the members of the group;
- presenting any materials prepared by a third party as one's own work, even if these materials are translations or adaptations, including work that is not original or exclusively that of the student (for example, generated with AI tools such as ChatGPT or Copilot);
- having communication devices (such as mobile phones, smart watches, etc.) accessible during theoretical-practical assessment tests (individual exams).
- talk to other student during the individual practical or theoretical tests.
- copying or trying to copy from other students during the individual practical or theoretical tests.
- using or trying to use written material related to the subject during the individual practical or theoretical tests when they have not been explicitly allowed.

When a student is involved in any evaluation irregularity, the final mark of the course will be the lowest value considering 3.0 and the weighted average of the grades (and no compensation is thus possible).

All in all: copying, allowing the copy, plagiarism (or just trying) in any of the assessment activities means failing the course, and makes it impossible to compensate or reuse any part of the assessment in the future.

Final grade

The final grade of the subject, which includes assessment of the acquisition of knowledge, skills and competencies, will be the average of the assessment parts weighted in this way:

- 35% the qualification of the final examination of validation of knowledge. The minimum mark required by this part is 5 out of 10.
- 35% the final grade of the practical part. The minimum mark required by this part is 5 out of 10.
- 15% the qualification of the controls of knowledge and skills. No minimum mark is required for this part.
- 5% the classification of the practical case. No minimum mark is required for this part.
- 10% of the grade of work done in class activities. No minimum mark is required for this part.

The final grade of 20% corresponding to the controls (15%) and the practical case (5%), CPC, will be calculated based on the mark obtained in the final exam. If the CPC 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 CPC, 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.

If the student do not pass the subject due to the fact that none of the assessment activities do not reach the minimum grade required, the numerical grade of the file will be the lowest value between 4.0 and the weighted average of the grades. 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 grade of the file will be the lowest value between 3.0 and the weighted average of the grades in case the student has committed irregularities in an evaluation act (and therefore not approved for compensation).

The granting of honors will be made taking into account the active participation in the development of the subject, for example collaborating in the resolution of problems in the forum of the subject, the obtaining of non-evaluable merits indicated during the course, the final grade of the subject, and the mark of the final proof of knowledge.

Evaluation schedule

Constantly: class activity and practices in the laboratory, with the corresponding reports.

After practical projects: evaluation session.

During the term: knowledge and skills controls and practical case.

At the end: validation exams of knowledge.

The evaluation dates will be published on the Campus Virtual and may be subject to changes of programming for reasons of adaptation to possible incidents. The Virtual Campus will always be informed about these changes as it is understood to be the usual mechanism for exchanging information between the teacher and students.

A resit of the final validation exam of knowledge is expected for those students who do not pass it on the first opportunity. It is also planned to make a second assessment of the lab projects for those students who have not delivered them at due time, although have been working on them during the term.

It is not possible to re-assess the class activities, nor the controls, nor the practical case, because they are part of the assessment that can not be failed (no minimum mark is required) and because they are part of the Continuous assessment (they do not make sense outside of the temporary context in which they are performed).

Students repeating the course

There will be no automatic re-use of previous assessments. Validations must be requested explicitly following the procedure that will be indicated on the first day of class.

Single Assessment

This course cannot be assessed using the single assessment option.

Bibliography

Basic references:

- D.E. Comer (2013). Internetworking with TCP/IP. Prentice Hall.

Supplementary references:

- G. Tomsho (2019). Guide to Networking Essentials, 6th Edition. Cengage.
- W. R. Stevens (1993). TCP/IP Illustrated, Volume I. Addison-Wesley.
- A.S. Tanenbaum (2021). Computer Networks, 6th Edition. Pearson.
- W. Stallings (2015). Comunicaciones y redes de computadores, 10a Edición. Pearson Prentice Hall.
- N. Barcia, C. Fernández, S. Frutos, G. López, L. Mengual, F.J. Soriano, F.J. Yáguez (2005). Redes de computadores y arquitecturas de comunicaciones. Supuestos prácticos. Pearson Prentice Hall.

Web links:

- cv.uab.cat
- <http://www.cs.purdue.edu/homes/dec/netbooks.html>

Software

This course will only use free software, such as the GNU/Linux operating system.

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	411	Catalan	second semester	morning-mixed
(PAUL) Classroom practices	412	Catalan	second semester	morning-mixed
(PAUL) Classroom practices	431	English	second semester	morning-mixed
(PAUL) Classroom practices	432	English	second semester	morning-mixed
(PAUL) Classroom practices	451	Catalan	second semester	afternoon
(PAUL) Classroom practices	452	Catalan	second semester	afternoon
(PAUL) Classroom practices	471	Catalan	second semester	afternoon
(PAUL) Classroom practices	472	Catalan	second semester	afternoon
(PLAB) Practical laboratories	411	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	412	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	413	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	414	Catalan	second semester	morning-mixed

(PLAB) Practical laboratories	415	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	416	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	417	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	418	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	419	English	second semester	morning-mixed
(PLAB) Practical laboratories	420	English	second semester	morning-mixed
(PLAB) Practical laboratories	421	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	422	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	423	English	second semester	morning-mixed
(PLAB) Practical laboratories	424	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	425	Catalan/Spanish	second semester	morning-mixed
(TE) Theory	41	Catalan	second semester	morning-mixed
(TE) Theory	43	English	second semester	morning-mixed
(TE) Theory	45	Catalan	second semester	afternoon
(TE) Theory	47	Catalan	second semester	afternoon