Advanced Networks and Security

Code: 42850
ECTS Credits: 6

2025/2026

Degree	Type	Year
Telecommunication Engineering	OB	1

Contact

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Knowledge of basic network communications architecture is desired.

Objectives and Contextualisation

The objective of this module is to go deeper into communication networks and their security. In particular, it will focus on providing students with knowledge about:

1. Introduction to the communication layers architecture and security in Internet
2. Description of the Internet architecture and the advanced routing protocols
3. Content Management services
4. Next Generation Internet protocols
5. Advanced network security

Competences

- Be capable of resolving convergence, interoperability and design of heterogeneous networks with local, access and truncal networks as well as the integration of telephone, data, television and interactive services.
- Be capable of understanding and knowing how to apply internet organisation and function, next generation internet technologies and protocols, components models, intermediary software and services.
- Capacity for modelling, designing, introducing, managing, operating, administrating and maintaining networks, services and content.
- Capacity for planning, decision-making and packaging of networks, services and applications considering the quality of service, direct and operating costs, the implementation plan, supervision, security procedures, scaling and maintenance and for managing and ensuring quality in the development process.
- Capacity for working in interdisciplinary teams
- Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent

- Students should know how to apply the knowledge they have acquired and their capacity for problem solving in new or little known fields within wider (or multidisciplinary) contexts related to the area of study
- Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously

Learning Outcomes

1. Capacity for working in interdisciplinary teams
2. Integrate services and security in current and next generation internet.
3. Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent
4. Students should know how to apply the knowledge they have acquired and their capacity for problem solving in new or little known fields within wider (or multidisciplinary) contexts related to the area of study
5. Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously
6. Understand global internet architecture and the channelling protocols used.
7. Understand security procedures in networks, services and applications.
8. Understand the advanced mechanisms of cryptography and the main attacks and security mechanisms on the different levels of the web and in next generation internet.
9. Understand the architecture of content management services
10. Understand the design and administration mechanisms of content management services.
11. Understand the layers of architecture in internet communications, protocols and principal services.
12. Understand the main protocols associated with the next generation of internet.

Content

Structure and contents:

1. Protocols and Architectures

- Protocols, interfaces and services
- Network architectures

2. Advanced Routing Protocols

- Internet architecture
- RIP
- OSPF
- BGPv4

3. Content Management Services

- CMS architecture
- CMS design & administration
- CMS Conclusions
- Content delivery networks (CDN)

4. Next Generation Internet

- IPv6
- Mobile IP
- Advanced networks
    - Mobile ad-hoc networks (MANET)
    - Opportunistic Networks (OppNet)

        - Wireless sensor networks
        - Service Advertisement and Discovery
        - Ubiquitous computing
        - Radio Frequency IDentification (RFID)
        - Big Data

5. Network Security

- Basic cryptography
    - Security mechanisms
- Attacks and prevention mechanisms at the different network layers
    - Attacks and prevention mechanisms at the network layer
    - Attacks and prevention mechanisms at the transport layer
    - Attacks and prevention mechanisms at the application layer
- Security in Next Generation Internet
    - Mobile IP security
    - Ad-hoc networks security
    - Wireless Sensor Networks security
    - OppNet security
    - Ubiquitous computing security
    - RFID security
    - Big Data security
    - Cryptocurrencies
    - Tor

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Directed activities	45	1.8	1, 8, 7, 9, 6, 10, 12, 11, 2, 4, 5, 3
Type: Supervised			
Supervised activities	15	0.6	1, 8, 7, 2, 4, 5, 3
Type: Autonomous			
Autonomous activities	90	3.6	1, 8, 7, 9, 6, 10, 12, 11, 2, 4, 5, 3

The work methodology will combine the face-to-face classes, the realization of works in the laboratory, the realization of works from recommended readings and the autonomous work of the student. It will make use of the virtual platform and the presentation of works related with the thematic blocks will be required.

Throughout the course the following activities will be carried out:

- Theory sessions (directed), where the teacher will provide information on the knowledge of the subject and on strategies to acquire, expand and organize this knowledge. The active participation of the students will be encouraged during these sessions, for example posing discussions in those points that admit diverse technological solutions.
- Problems sessions (directed), where the students will have to actively take part to consolidate the knowledge acquired by solving, presenting and debating related problems. Problems are distinguished from the exercises, which can be considered as trivial problems. The problems will often admit several solutions and may cause debate among the students.

- Laboratory practical sessions (supervised and autonomous), where small projects will be proposed to be analysed and developed by the students in group. The sessions will be previously prepared, documented and programmed by the teacher, and the students will have to prepare them before attending, reviewing the related theoretical knowledge and the basic technical aspects of the development. The laboratory sessions should serve students to achieve the skills of the subject and contribute to achieve some skills such as autonomous work.
- Preparation of the Portfolio of the subject (autonomous), in a virtual way through a collaborative Portfolio. Students will have to work autonomously in teams in the research and the preparation of the corresponding material of the evidences of his theory and problems learning, and in the study of this material. The evidences include extensions of the different topics exposed to the sessions of theory and collaborative problem solving. The teacher will monitor the work of the different teams, will provide feedback to the teams depending on the task done and the doubts they raise or the errors they manifest. The preparation of the Portfolio should serve students to help achieve the competencies of the subject. The teaching methodology and assessment are closely linked to the Virtual Portfolio system, which is the cohesive element of the different teaching activities during the course, and which allows a system of continuous and formative assessment, incorporated into the teaching/learning process. The Portfolio will help the students to develop a constant work that will take them to reach the proposed knowledge, and the skills and competences associated with the theory and problems parts.

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
Delivery of reports or problems in the virtual portfolio	25% The minimum grade required for this part is 5 out of 10	0	0	1, 8, 7, 9, 6, 10, 12, 11, 2, 4, 5, 3
Presentations and participation in the problems and cases seminars	10% No minimum grade is required for this part	0	0	1, 8, 7, 9, 6, 10, 12, 11, 2, 4, 5, 3
Work in the laboratory and corresponding memories	25% The minimum grade required for this part is 5 out of 10	0	0	1, 8, 7, 2, 4, 5, 3
Written tests	40% The minimum grade required for this part is 5 out of 10	0	0	8, 7, 9, 6, 10, 12, 11, 2, 4, 5, 3

Assessment systems

- Written tests: Partial and final written tests
- Delivery of reports or problems: Brief reports on specific subjects
- Work in the laboratory and corresponding memories: it will assess the previous preparation of the laboratory session, the capacity to carry out it in an efficient form and the quality of the analyses reflected in the memory.
- Presentations and participation in the problems and cases seminars: it will assess the previous preparation of the questions/exercises/cases assigned for the session.

The final mark for the course, that includes the assessment of the acquisition of knowledge and skills, is calculated in the following way:

- 25%, from the mark of the work done in delivery of reports or problems. The minimum required in this part is 5 out of 10.
  If the student passes the validation of knowledge tests and the minimum of the work in the Portfolio is not reached, this part may be retaken before the closing date for marks.
- 40%, from the mark of the written tests. The minimum required in this part is 5 out of 10.
  To carry out the validation of the knowledge, there will be two partial tests during the year (a partial test to assess Part I of the course and a partial test to assess Part II of the course) and a final exam (to assess both parts).
  If the student gets more than 4 in any of the two partial tests, no additional assessment from this part in the final exam is required (the mark of this part will be the one from the partial exam). The final mark will be the average of the marks obtained in both parts. To calculate the average, the student must obtain more than a mark of 4 in each of the parts (either in the partials or in the final tests). In case that a student gets more than 4 in both partial tests, but the average is lower than 5, the final exam of the part with a mark lower than 5 will have to be taken (in case both parts are lower than 5, the student will be able to decide to take the final exam of both parts or only 1 of them).
- 10%, from the mark of the work in the presentations and participation in the problems and cases seminars. No minimum is required for this part.
- 25%, from the mark of the laboratory. The minimum required in this part is 5 out of 10. In order to make the average, the student must have obtained more than 4 in each one of the laboratory sessions.
  If the student does not get the minimum mark of the laboratory sessions, this part may be retaken before the closing date for marks.

A minimum final grade of 5 is required to pass the course.

In the event of failing the subject because any of the assessment activities does not reach the minimum mark required, the final grade will be the lower value between 4.5 and the weighted average of the marks, with the exception that students who do not participate in any of the evaluation activities will be given the grade of 'not evaluable'.

This course does not consider the single assessment system.

The assessment mechanisms used in the subject are described in more detail below.

Schedule of assessment activities

The dates of continuous assessment and delivery of works will be published the first day of the course on the Virtual Campus and may be subject to possible changes due to adaptation to possible incidents. These changes will always be reported on the Virtual Campus since it is understood that this is the usual platform for the exchange of information between teachers and students.

The following assessment activities are planned:

- Portfolio: weekly
- Classroom activities: in the problems classes
- Laboratory: 5 sessions during the course, in general every other week
- Theory partial exams of parts I and II of the subject: around weeks 10 and 15
- Theory final exam

Retaking process

Students may take the retaking process if they have taken a set of activities that represent at least two-thirds of the total grade of the course.

Retaking mechanisms will focus on activities 1) Portfolio, 2) Validation of Knowledge, 3) Laboratory sessions. In the event that a student has not passed any, or all of these parts, before the date of the final exam, this part can be retaken by means of a written test (cases 2 and 3), making a second delivery of the laboratory report (case 3) or finishing the Portfolio before that date (case 1). In case 1, if the student retakes the Portfolio part, a

pass or fail will be obtained. If the student passes, a maximum mark of 5 will be obtained. If the student fails, the mark previously obtained in this part will be obtained.

Review of the exam procedure

For each assessment activity, a place, date and time of revision will be indicated in which the student will be able to review the activity with the teacher. In this context, claims may be made about the activity mark, which will be assessed by the teacher responsible for the subject. Unless otherwise noted, if the student does not attend this revision, this activity will not be reviewed later.

Special grades

When a student has not done any work in laboratory, has not taken any of the partial or final theory written tests, and has a mark lower than 5 in the work in the presentations and participation in the problems and cases seminars, it will be considered that there are not enough assessment evidences, and the final mark will be "not assessable." The rest of students who have not passed the course will get a "Suspens" (fail) grade, with the mark obtained in the subject. Those students qualified with "Suspens" due to nothaving reached the minimum mark in any ofthe assessment tests, will havethe mark got in the assessment exam that has not reached the minimum required (always taking the minimum mark in the case that the minimum in several tests is not obtained).

Honor grade (Matrícula d'Honor, MH): Granting an honor grade qualification is a decision of the faculty responsible for the subject. The regulations of the UAB indicate that MH can only be awarded to students who have obtained a final grade of 9.00 or more. It can be granted up to 5% of MH of the total number of students enrolled.

Use of AI

In this subject, the use of Artificial Intelligence (AI) technologies is allowed exclusively in support tasks, such as bibliographic or information search. The student will have to clearly identify which parts have been generated or improved with this technology, specify the tools used and finally include a critical reflection on how these have influenced the process and the final result of the activity. Non-transparency of the use of AI will be considered academic dishonesty and may lead to a partial or total penalty in the grade of the activity, or higher penalties in serious cases.

Student irregularities, copy, and plagiarism

Without prejudice to other disciplinary measures deemed appropriate, and in accordance with current academic regulations, irregularities committed by a student that may lead to a variation in the grade will be graded with a zero (0). Assessment activities graded in this way and by this procedure will not be recoverable. If it is necessary to pass any of these assessment activities in order to pass the subject, this subject will be directly failed, with no opportunity to recover it in the same course. These irregularities include, among others:

- Total or partial copying of a practical, report, or any other assessment activity;
- Letting a student copy;
- Submitting group work that has not been completed in its entirety by the members of the group;
- Submitting as one's own materials produced by a third party, even if they are translations or adaptations, and generally work with elements that are not original and unique to the student;
- Having communication devices (such as mobile phones, smartwatches, etc.) accessible during individual theoretical-practical assessment tests (exams).

The numerical grade of the transcript will be the lower value between 3.0 and the weighted average of the grades in case the student has committed irregularities in an evaluation act (and, therefore, it will not be possible to pass it by compensation).

Assessment of repeater students

Repeater students will be able to validate the theory part of the subject. The way to calculate the final mark will be the same as mentioned above, taking the note from the Portfolio, classroom activities and exam(s) of the part(s) of the theory to validate.

Repeater students will also be able to validate the laboratory sessions separately. The way to calculate the final mark will be the same as mentioned above, taking the mark from the laboratory session(s) to validate.

Bibliography

- Aspectos avanzados de seguridad en redes. Jordi Herrera Joancomartí (coord.), Joaquín García Alfaro, Xavier Perramón Tornil. Segunda edición, febrero 2007. Fundació per a la Universitat Oberta de Catalunya (http://openaccess.uoc.edu/webapps/o2/handle/10609/204)

Software

The laboratory sessions will use:

- openssl
- OpenPGP
- SSH
- dockers
- iptables
- nmap
- netstat
- ss (iproute2)
- nmap

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(TEmRD) Teoria (màster RD)	1	English	first semester	morning-mixed