UAB
Universitat Autònoma de Barcelona

2023/2024

Telecommunications Services

Code: 102700
ECTS Credits: 6

Degree	Type	Year	Semester
2500898 Telecommunication Systems Engineering	OB	4	1

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

Vladimir Bellavista Parent

Prerequisites

Students should have completed Fonaments de Xarxes (Network Fundamentals) and Xarxes de Telecomunicació (Telecommunication Networks), and have an adequate level of programming.

Objectives and Contextualisation

- Review the architecture and protocols of telematic networks.
- Briefly introduce Security in services related to multimedia information
- Know the mechanisms of coding and storage of multimedia information
- Introduce the processing of multimedia information
- Know different transport mechanisms of multimedia information
- Introduce the concept of Quality of Service in multimedia networks
- Know some of the classic, new generation and security services related to multimedia information

Competences

- Analyse and evaluate the social and environmental impact of technical solutions.
- Apply the necessary legislation in the exercise of the telecommunications engineer's profession and use the compulsory specifications, regulations and standards.
- Communication

- Design and dimension multiuser communication systems using the principles of communication theory under the restrictions imposed by the specifications and the need to provide a quality service.
- Develop ethics and professionalism.
- Develop personal attitude.
- Develop personal work habits.
- Develop thinking habits.
- Draft, develop and sign projects in the field of telecommunications engineering that, depending on the speciality, are aimed at the conception, development or exploitation of telecommunication and electronic networks, services and applications.
- Learn new methods and technologies, building on basic technological knowledge, to be able to adapt to new situations.
- Perform measurements, calculations, estimations, valuations, analyses, studies, reports, task-scheduling and other similar work in the field of telecommunication systems.
- Resolve problems with initiative and creativity. Make decisions. Communicate and transmit knowledge, skills and abilities, in awareness of the ethical and professional responsibilities involved in a telecommunications engineer's work.
- Work in a multidisciplinary group and in a multilingual environment, and communicate, both in writing and orally, knowledge, procedures, results and ideas related with telecommunications and electronics.
- Work in a team.

Learning Outcomes

1. Adapt to multidisciplinary environments.
2. Apply the techniques in networks, services, processes and telecom applications in both fixed and mobile environments, personal, local or long distance with different band widths, including telephony, radio, television and data are based from the point of view transmission systems.
3. Assume and respect the role of the different members of a team, as well as the different levels of dependency in the team.
4. Communicate efficiently, orally and in writing, knowledge, results and skills, both professionally and to non-expert audiences.
5. Consider and evaluate different technical solutions for the provision of telecommunications services and select those that offer adequate commitment to social and environmental impact.
6. Construct, operate and manage networks, services, processes and telecom applications, understood these as systems of recruitment, transportation, representation, processing, storage, management and presentation of multimedia information, from the point of view of the transmission systems.
7. Critically evaluate the work done.
8. Develop critical thinking and reasoning.
9. Develop curiosity and creativity.
10. Develop independent learning strategies.
11. Develop the capacity for analysis and synthesis.
12. Differentiate and understand the significance of measurements and assessments of telecommunications networks to Formenta and ensure their optimal design.
13. Discuss and apply cryptography systems aimed at improving the safety of a telecommunication network.
14. Discuss in multidisciplinary groups knowledge, procedures, results and ideas related to telecommunications networks and services.
15. Distinguish the different nature of the problems of dimensioning and routing for each of the different types of networks and make decisions and initiatives to improve the operation and provision of telecommunications networks.
16. Efficiently use ICT for the communication and transmission of ideas and results.
17. Evaluate the advantages and disadvantages of different conceptual and technological options for different telecommunication applications.
18. Manage available time and resources.
19. Manage networks, services, processes and telecom applications according to the laws and regulations both domestically and internationally.
20. Recognize telecommunication services, based on the feedback systems, transport, representation, processing, storage, management and presentation of multimedia information.
21. Respect diversity in ideas, people and situations.

22. Use communication and computer applications (office automation, databases, advanced calculation, project management, display, etc.) to support the development and exploitation of telecommunication and electronic networks, services and applications.
23. Work autonomously.
24. Work cooperatively.

Content

The course is divided into 7 subjects, which revolve around multimedia information systems and services:

1. Presentation
2. Introduction
    1. Layer architecture
    2. Network interconnection
    3. Classification of networks
3. Security
    1. Introduction
    2. Threats and Protection of resources
    3. Basic cryptography
    4. Symmetric key cryptography
    5. Public key cryptography
    6. Digital signature
    7. No denial
    8. Summary of techniques
    9. Secure communication protocols
    10. Secure email
    11. Key management
    12. Public key infrastructure (*Public-key Infrastructure*, PKI)
4. Multimedia Information
    1. Introduction
    2. Data
    3. Audio
    4. Images
    5. Video
    6. Compression
    7. Performance
5. Information Processing
    1. Introduction
    2. The Client/Server model
    3. Distributed data processing
    4. Distributed data
    5. Additional considerations
6. Information Transport
    1. Introduction
    2. Internet architecture
7. Quality of Service in Multimedia Networks
    1. Introduction
    2. Quality of Service
    3. Error control
    4. Flow control
    5. Congestion control
    6. Queue management
    7. Multimedia support in networks
8. Services
    1. Introduction
    2. Classic services

1. Email
        2. HTTP
    3. Multimedia services
        1. Content distribution networks
        2. *Real-time Transport Protocol* (RTP)
        3. Real-time video playback
        4. Voice over IP (VoIP)
    4. New generation services
        1. Intranets/Extranets
        2. Service-oriented architectures
        3. Grid computing and Cloud computing
        4. Opportunistic Networks (OppNet)
    5. Security services
        1. Secure Sockets Layer (SSL/TLS)
        2. Virtual private networks (VPN)
        3. Firewall
        4. Intrusion detection systems
        5. Cryptocurrencies
        6. Tor

Methodology

During the course, we will carry out the following activities:

- Theory sessions, where the teacher will provide information on the knowledge of the subject and on strategies to acquire, expand and organise 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, 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, where small projects will be proposed to be analysed and developed by the students in a 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, 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, 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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory sessions	12	0.48	2, 3, 17, 4, 5, 6, 11, 9, 13, 18, 20, 21, 24, 22
Problems classes	10	0.4	1, 2, 7, 17, 4, 6, 11, 9, 14, 13, 20, 24, 23
Theory classes	26	1.04	2, 17, 6, 11, 9, 8, 12, 13, 15, 19, 20
Type: Supervised			
Tutored jobs and wiki queries	8	0.32	2, 17, 4, 6, 11, 13, 16, 20, 22
Type: Autonomous			
Laboratory preparation and autonomous work	26	1.04	1, 2, 3, 7, 17, 4, 5, 6, 10, 11, 18, 21, 24, 23
Preparation of the virtual portfolio (wiki) of the course	30	1.2	1, 2, 3, 17, 4, 6, 10, 11, 9, 13, 16, 18, 20, 21, 24, 23
Study and preparation of the assesment tests	28	1.12	2, 7, 17, 6, 10, 9, 13, 18, 20, 23

Assessment

Scheduled assessment process and activities

The final grade of the subject, which includes assessment on the acquisition of knowledge, skills and competences, will be calculated by weighting:

- In 30% the qualification of the work done in the Portfolio. The minimum grade required for this part is 5 out of 10.
  If a student passes the validation of knowledge tests but does not reach the minimum of work in the Portfolio, this part may be retaken before the closing date for marks.
- In 30% the validation qualification of knowledge. The minimum grade required for this part is 5 out of 10. To carry out the validation of knowledge, two partial tests will be done during the course (a partial test to evaluate part I of the subject and another partial test to evaluate part II of the subject) and a final exam (which will evaluate both parts). If the student takes more than a 4 in one of the two parts in the partial tests, it should not be evaluated again of this part in the final exam (the note for this part will be that of the partial). The validation note will finally be the average of the marks obtained in the two parts. In order to make the average, the student must have obtained more than 4 in the theoretical exam of each part (either partial or in the corresponding part of the end). In case a student gets more than 4 in the two partial tests, but the average is less than 5, the final exam of the part with a grade lower than 5 must be presented (in case both parts are less than 5, the student can decide if to take the final exam of the two parts or only of 1 of them).
- In 15% the qualification of the work done to the activities in class. No minimum grade is required for this part.
- In 25% the qualification of the laboratory sessions. The minimum grade required for this part is 5 out of 10.
  If the minimum qualification of the laboratory sessions is not achieved, this part may be retaken before the closing date for marks.

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

When a student does not pass any of the parts that require a minimum mark, the average will be calculated with the marks obtained. If this average is equal to or less than 4.9, the final grade will be this average, whereas if it is greater than 4.9 the final grade will be 4.9 (S).

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 for continuous assessment and submission of papers will be published on the first day of the subject in the Virtual Campus and may be subject to possible changes in programming for reasons of adaptation to possible incidents. Always be informed on the Virtual Campus about these changes as it is understood that this is the usual platform for exchange of information between teachers and students.

The following assessment activities are foreseen:

- Portfolio: weekly
- Activities in class: weekly
- Laboratory: 4 sessions during the course, day and time depending on the laboratory group
- Validation test of laboratory practices 1 and 2, once the sessions are finished
- Partial exams of theory of parts I and II of the subject: around weeks 10 and 15
- Final theory 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.

Procedure to review the assessment

For each assessment activity, a place, date and time of revision in which the student can review the activity with the teacher will be indicated. In this context, claims may be made on the activity grade, which will be evaluated by the faculty responsible for the subject. If not specified otherwise, if the student does not appear in this revision, this activity will not be reviewed later.

Special qualifications

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 portfolio, 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 not having reached the minimum mark in any of the assessment tests, will have the 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.

Irregularities by student parts, copy and plagiarism

Without prejudice to other disciplinary measures deemed appropriate, and in accordance with current academic regulations, any irregularities committed by the student that could lead to a variation of the grade of an assessment act will be scored with a zero. Therefore, copying or allowing to copy a laboratory work or any other assessment activity will involve suspending with a zero, and if it is necessary to pass it to pass, the whole subject will be suspended. The assessment activities qualified in this way and by this procedure will not be recoverable, and therefore the subject will be suspended directly without the opportunity to recover it in the same academic year.

Assessment of repeater students

Repeater students can validate the theory part of the subject. The way to calculate the final grade will be the same as the one mentioned above, taking the note of the Portfolio, activities in class and exam of the theory part validate.

Repeater students will also be able to validate the laboratory work separately. The way to calculate the final grade will be the same as the one mentioned above, taking the note of the laboratory practice (or practices) that has been validated.

Details about the laboratory

The laboratory sessions consist in the accomplishment of a series of works with which they try to reach knowledge and abilities seen in theory or totally new. It is considered equally important to have worked throughout the development of the laboratory, as having understood and learned the knowledge to them.

In the development of the subject, two projects will be carried out in the fields of:

- Creation of a dynamic web-site (2 weeks x 2 hours)
- Security (2 weeks x 2 hours)

The specific details on the organization of the laboratories (groups, calendar, weighting, ...) and on their follow-up (reports, attendance requirements, policy on originality of the code, ...) can be downloaded from the Virtual Campus.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assessment of the development of the virtual portfolio (wiki)	30% The minimum grade required for this part is 5 out of 10	1	0.04	2, 17, 4, 6, 11, 9, 13, 16, 18, 20, 24, 23, 22
Class activities	15% No minimum grade is required for this part	2	0.08	2, 7, 17, 4, 6, 10, 11, 9, 8, 12, 14, 13, 15, 18, 19, 20, 24, 23
Follow-up of the laboratory sessions	25% The minimum grade required for this part is 5 out of 10	3	0.12	1, 2, 3, 7, 17, 4, 5, 6, 11, 9, 8, 16, 18, 21, 24, 22
Knowledge validation tests	30% The minimum grade required for this part is 5 out of 10	4	0.16	2, 17, 4, 6, 11, 9, 12, 13, 15, 18, 20

Bibliography

Basic bibliography

- Business Data Communications, 7e, William Stallings and Tom Case, Prentice Hall September 2012 ©

Supplementary bibliography

- Computer Networking: A Top Down Approach, 7e, Jim Kurose and Keith Ross, Addison-Wesley, May 2016 ©

Software

The laboratory sessions will use:

- PHP
- MySQL
- Apache
- openssl