

Course guide 340357 - INTE-C5044 - Internet

Last modified: 05/02/2025

Unit in charge: Teaching unit:	Vilanova i la Geltrú School of Engineering 744 - ENTEL - Department of Network Engineering.
Degree:	BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject). BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject). BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject). BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2018). (Compulsory subject).
Academic year: 2024	ECTS Credits: 6.0 Languages: Catalan, Spanish

LECTURER				
Coordinating lecturer:	Guasch Murillo, Daniel			
Others:	Guasch Murillo, Daniel Piney Da Silva, Jose Ramon Jofre Cruanyes, Marc			

PRIOR SKILLS

No previous skills are required to take the subject.

REQUIREMENTS

It is recommended to have taken the subject of Xarxes de Computadores (XACO).

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. CEFB5. Knowledge of informatic systems, its structure, function and interconnection, as well as fundamentals of its programming.

2. CETI2. Ability to select, design, develop, integrate, value, construct, tmanage, exploit and maintain technologies of machines, programming and nets, keeping suitable costs and quality parameters.

3. CETI4. Ability to select, design, deploy, integrate and manage network and communications infrastructure in an organization.

4. CETI6. Ability to design systems, applications and services based on network technologies, including internet, website, ecommerce, multimedia, interactive services and mobile computing.

5. CETI7. Ability to understand, implement and manage security and safety of computing systems.

6. CE12. Knowledge and use of the basics of programming networks, sistems, telecommunication services.

7. CE17. Knowledge and use of the concepts of network architecture, protocols and communication interfaces.

8. CE18. Ability to distinguish net concepts of access and transport, circuits and package commutation nets, fixed and mobile nets, as well as of application systems of distributed nets, voic, data and audio services and interactive and mutimedia services.

9. CE19. Knowledge of interconnection and routing methods, as well as basics of planning, network dimensioning based on traffic parameters.

10. CE2. Basic knowledge of use and programming computer, operating systems, data base and informatic programs with engineering applications.



Transversal:

12. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

18. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thoughtbuilding and decision-making. Taking part in debates about issues related to the own field of specialization.

19. 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.

23. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.

25. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

TEACHING METHODOLOGY

There will be two types of classes, theory and laboratory. In the theory classes, the teacher will present the knowledge to be developed in the subject in an expository manner using multimedia material, which will be available in advance at Atenea, and other resources such as technical documentation or solved examples on the board. In the laboratory sessions, the students will work in pairs to solve the guided practical exercises aimed at consolidating the knowledge acquired in the theory sessions. Some examples of these exercises are the assembly and configuration of a network or the analysis of a protocol. Work will also be done on the acquisition of practical skills relating to the use of tools and equipment specific to networks and specifically the Internet, which will be used on a recurring basis. For example, the Wireshark protocol analyzer or routers.

These sessions will be accompanied by non-face-to-face work directed at three fronts. The first, the study and understanding of knowledge acquired in theory classes. The second, the individual response to the questionnaires associated with each practice, which will be taken into account in the grade intended to evaluate participation (see, "monitoring tasks"). The third, to develop programming skills aimed at solving a challenge related to the Internet and TCP/IP protocols.

LEARNING OBJECTIVES OF THE SUBJECT

The subject is designed so that the student acquires a broad knowledge base, both theoretical and practical, related to TCP/IP networks in general and to the Internet in particular.

After completing the course, the student will be able to:

- Explain the TCP / IP architecture.
- Explain the format of the packages, the addresses, the error control mechanisms and the assignment of IPv4 and IPv6 addresses.
- Explain and apply the concepts of CDIR and NAT.
- Plan and configure the addressing of an IP network.
- Explain the operation of a router and configure it.
- Distinguish between exterior and interior routing and distance vector and link state paradigms.
- Configure different dynamic routing protocols and explain their operation.
- Explain the DNS system.
- Explain the concepts of port, socket and connection.
- Explain TCP and UDP transport protocols, their associated headers and functionalities.
- Choose the most appropriate transport protocol based on the characteristics of the service to be developed.
- Explain the client-server and P2P service models.
- Explain and analyze the operation of the classic Internet services: remote terminal, file transfer, mail and Web.
- Know the different options to protect a TCP/IP network or service.
- Explain what a firewall is and configure it.
- Explain the concept of encryption, authentication, VPN and AAA.
- Explain how to manage a TCP/IP network and configure an item to be manageable.
- Program a TCP/IP protocol or functionality associated with TCP / IP network.



STUDY LOAD

Туре	Hours	Percentage
Hours large group	30,0	20.00
Self study	90,0	60.00
Hours small group	30,0	20.00

Total learning time: 150 h

CONTENTS

Topic 1: Introduction

Description:

Presentation of the subject. Network architecture. TCP/IP protocol stack. Encapsulation. Devices that make up a network. Internet Organization and Standards (RFCs).

Related activities:

[P1] Design, configuration and test of a TCP/IP network

Full-or-part-time: 10h Theory classes: 4h Self study : 6h

Topic 2: Addressing

Description:

IPv4 (CDIR and NAT). IPv6. Physical addresses (MAC) and relationship with logic addresses (ARP). Identification of services / processes (ports, sockets and connections). Identification by service or machine names (DNS). Automatic configuration mechanisms (DHCP).

Related activities:

[P1] Design, configuration and test of a TCP/IP network

Full-or-part-time: 10h

Theory classes: 4h Self study : 6h

Topic 3: Packet delivery

Description:

Packet switching, datagram mode. Best Effort versus quality of service (QoS). Routing table (format and type of entries). Fragmentation of packages. IPv4 and IPv6 headers. ICMP and ICMPv6 protocols.

Related activities:

[P1] Design, configuration and test of a TCP/IP network

Full-or-part-time: 10h Theory classes: 4h Self study : 6h



Topic 4: Routing

Description:

Concepts of metric, cost and algorithm. Vector distance vs. link status (Bellman-Ford and Dijkstra algorithms). Protocols IGP vs. EGP. RIP and OSPF protocols.

Related activities:

[P1] Design, configuration and test of a TCP/IP network

Full-or-part-time: 10h Theory classes: 4h Self study : 6h

Topic 5: Information delivery

Description:

Transport layer TCP and UDP protocols (features and headers). [R] Resolution of TCP/IP challenges

Related activities: [P1] Design, configuration and test of a TCP/IP network

Full-or-part-time: 10h Laboratory classes: 4h Self study : 6h

Topic 6: Services

Description:

Classic internet services: remote terminal (Telnet), file transfer (FTP), email (SMTP, POP3 and IMAP4), Web (HTTP).

Related activities:

[P2] Analysis of TCP/IP services[R] Resolution of TCP/IP challenges

Full-or-part-time: 15h Theory classes: 6h Self study : 9h

Topic 7: Security

Description:

Security requirements (security perimeter, confidentiality, integrity, authentication, non-repudiation, availability, access control). Protection elements (firewalls, encryption, public and private keys, certificates). Protocols (IPsec, TLS, SSH, HTTPS, VPNs, AAA).

Related activities:

[P3] Security in TCP/IP networks[R] Resolution of TCP/IP challenges

Full-or-part-time: 10h Theory classes: 4h Self study : 6h



ACTIVITIES

[P1] Design, configuration and test of a TCP/IP network

Description:

Organized in sessions. At the end of each one of them, the answers will be given to a small individual questionnaire. It will work:

- Equipment: Hosts and routers.
- Basic configuration tools, connectivity, ARP tables, DNS queries.
- Address allocation (DHCP).
- Addressing plan, CDIR.
- Static routing.
- Dynamic routing.

Full-or-part-time: 24h

Self study: 12h

Laboratory classes: 12h

[P2] Analysis of TCP/IP services

Description:

Organized in sessions. At the end of each of them, the answers of a small individual questionnaire will be delivered. It will work:

- Analysis of ports, connections and their states. Scanning of ports.
- Analysis protocols Telnet, FTP, Web (HTTP).

Full-or-part-time: 20h

Self study: 10h Laboratory classes: 10h

[P3] Security in TCP/IP networks

Description:

Organized in sessions. At the end of each one of them, the answers will be given to a small individual questionnaire. It will work: - Configuration of a firewall. Packet filtering.

- Authentication and encryption mechanisms.

Full-or-part-time: 16h Self study: 8h Laboratory classes: 8h

[R] Resolution of TCP/IP challenges

Description:

Non-contact activity. Resolution of a minimum of two challenges proposed by the teacher. Resolving these challenges may involve, for example, the programming of a protocol or the test of a TCP / IP service. The assessment will be based on the documentation provided by the student and if the teacher asks for it, a presentation or demonstration. Important: For those students who study the subject as an optional one, they will present a work of dedication and equivalent difficulty that is in accordance with their previous knowledge.

Full-or-part-time: 15h Self study: 15h



GRADING SYSTEM

The subject's grade is obtained from 3 assessment tests.

- Partial exam. This test evaluates the content worked on in the subject up to the date of completion. Your grade represents 25% of the subject grade.

- Internships The practical assignments of the subject are graded, with the corresponding percentages depending on the dedicated sessions. Your grade represents 25% of the subject grade.

- Final exam. All the contents of the subject are evaluated. Your grade represents 50% of the subject grade.

The re-evaluation of the subject consists of taking an exam in which all the contents of the subject are evaluated. Your grade represents 60% of the subject grade, replacing the grades of the midterm and final exams.

EXAMINATION RULES.

Si se detecta que parte del contenido de una prueba evaluable (práctica, problema, trabajo, examen, etc.) ha sido plagiado o generado con inteligencia artificial, toda la prueba se calificará con un cero. En caso de reincidencia, toda la asignatura se calificará con un cero. En ambos casos se informará al jefe de estudios de la escuela. Al mismo tiempo, toda prueba entregada fuera de plazo o por un medio diferente al establecido, se considerará como no entregada.

BIBLIOGRAPHY

Basic:

- Feit, Sidnie; Sánchez Allende, Jesús; Moreno Díaz, Pilar; Vaquero Sánchez, Antonio; Fenández Manjón, Baltasar. TCP/IP : arquitectura, protocolos e implementación con IPv6 y seguridad de IP. 2a ed. Madrid [etc.]: McGraw-Hill, 2004. ISBN 8448142969.

- Kurose, James F; Ross, Keith W. Computer networking : a top-down approach. 8th ed. Harlow, United Kingdom: Pearson Education Limited, 2022. ISBN 9781292405469.

- Comer, Douglas E. Internetworking with TCP/IP , vol. 1. 6th ed. Uttar Pradesh, India: Pearson Education, 2015. ISBN 9781292040813.

RESOURCES

Hyperlink:

- Apunts d'Internet: 1. Introducció. Internet notes: 1. Introduction - http://hdl.handle.net/2117/363003- Apunts d'Internet: 2. Addressing - http://hdl.handle.net/2117/363005- Apunts d'Internet: 3. Encaminament. Internet notes: 3. Routing - http://hdl.handle.net/2117/363009- Apunts d'Internet: 4. Lliurament. Internet notes: 4. Delivery - http://hdl.handle.net/2117/363009- Apunts d'Internet: 5. Garanties. Internet notes: 5. Guarantee - http://hdl.handle.net/2117/363010- Apunts d'Internet: 5. Garanties. Internet notes: 5. Guarantee - http://hdl.handle.net/2117/363015- Apunts d'Internet: 6. Serveis. Internet notes: 6. Services - http://hdl.handle.net/2117/363017- Apunts d'Internet: 7. Seguretat . Internet notes: 7. Security - http://hdl.handle.net/2117/363017- Apunts d'Internet: 7. Seguretat . Internet notes: 7. Security - http://hdl.handle.net/2117/363017- Apunts d'Internet: 7. Seguretat . Internet notes: 7. Security - http://hdl.handle.net/2117/363020