

Academic Year: (2021 / 2022)

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Department assigned to the subject: Telematic Engineering Department

Coordinating teacher: GARCIA RUBIO, CARLOS

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

A content subject similar to the subject "Computer Networks", of the Bachelor in Informatics Engineering of the UC3M.

OBJECTIVES

The objective of this subject is to study advanced aspects of the protocols that support the Internet, in particular the advanced aspects of the transport layer, security and the main application-layer protocols of the Internet: DNS, email, file transfer , remote terminal, web and others.

After taking the course, the student must:

- Understand the advanced functions of transport protocols (for example, TCP congestion and flow control mechanisms).
- Know the basic principles of cryptography and encryption, symmetric and public key algorithms, digital signature, message summary, public key infrastructure, security in transport level communications (TLS) and application.
- Know the messages and basic formats, operation, and architecture of the different application-level protocols dealt with by the subject: name service, remote terminal, file transfer, email, web.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Network layer:

- Review. IP packet format. Addressing. NAT. Routing protocols (RIP, OSPF, BGP). ICMP. IGMP. DHCP. IPv6
- Mobile IP. Security at the network layer. IPsec and VPNs

2. Transport layer:

- Review of transport layer. UDP. TCP. Classic variants of TCP (Tahoe, Reno).
- New TCP implementations.
- Congestion control.
- Security at transport level. TLS / DTLS.

3. Application layer:

- DNS. Review basic concepts. Advanced DNS. DNSSEC and DDNS. DoH and DoT.
- Remote terminal protocols. Telnet, rlogin and ssh.
- Files transfer protocols. FTP and TFTP.
- Email service. RFC 822, MIME, SMTP, POP and IMAP. ESMTP, Security (STARTTLS, S-MIME), spam (spf, dkim).
- Web service. HTTP / 1.X. HTTP / 2. IoT protocols: CoAP and MQTT. HTTP/3 and QUIC
- Multimedia communications protocols. RTP, RTCP, RTSP, SIP. Content distribution networks (CDN).
- Network management protocols.

LEARNING ACTIVITIES AND METHODOLOGY

FORMATION ACTIVITIES

AF1 - Theoretical class [32 hours with 100% attendance, 1.06 ECTS]
AF2 - Practical classes [12 hours with 100% attendance, 0.4 ECTS]
AF4 - Computer room [10 hours with 100% attendance, 0.34 ECTS]
AF7 - Individual student work [122 hours with 0% attendance, 4.06 ECTS]
AF8 - Midterm and final exams [4 hours with 100% attendance, 0.14 ECTS]

TEACHING METHODOLOGIES

MD1 - Lectures in the teacher's class supported by computer and audiovisual media, in which the main concepts of the subject are developed and the bibliography is provided to complement the students' learning.

MD3 - Resolution of practical cases, problems, etc ... raised by the teacher individually or in groups

MD4 - Presentation and discussion in class, under the moderation of the teacher of topics related to the content of the subject, as well as practical cases

MD5 - Preparation of works and reports individually or in groups

ASSESSMENT SYSTEM

% end-of-term-examination/test:	40
% of continuous assessment (assignments, laboratory, practicals...):	60

SE2 Individual or group work carried out during the course. Practices and exercises: 60%.

Practices and exercises made in the lab will be evaluated.

SE3 Final exam: 40%.

It will consist on a written exam to assess both the theoretical and the practical concepts acquired by the student.

In the extraordinary examination (July) the mark of final exam will have a weight of 100% in the assessment.

- If the student followed the continual evaluation, the final exam will have the same percent value than in the ordinary examination, and the mark of the continual evaluation will be taken into account.
- If the student did not follow the continual evaluation, she/he will have the right to be evaluated with the 100% of the mark through the final exam.
- If the student followed the continual evaluation, she/he will have the right to obtain the higher mark obtained directly 100% from the final exam or taking into account the continual evaluation.

BASIC BIBLIOGRAPHY

- Dordal, Peter L. An Introduction to Computer Networks, <http://intronetworks.cs.luc.edu>, 2021
- Forouzan, Behrouz A TCP/IP protocol suite, 4th Ed. McGraw-Hill., 2010
- Ilya Grigorik High Performance Browser Networking, O'Reilly (available in <https://hpbn.co/>), 2013 / 2015
- Kurose, James F, and Keith W. Ross Computer Networking: A Top-Down Approach, 7th Ed. Pearson., 2017
- Ron Aitchison Pro DNS and BIND 10, Apress, 2011

ADDITIONAL BIBLIOGRAPHY

- Andrew.S.Tanenbaumi, David J. Wetherall. Computer Networks, 5th Ed. Prentice Hall, 2011
- Kevin R. Fall, W. Richard Stevens TCP/IP Illustrated, Vol. 1: The Protocols, 2nd Ed. Addison-Wesley Professional Computing Series., 2012
- Subir Varma Internet Congestion Control, Morgan Kaufmann, 2015
- W. R. Stevens TCP/IP Illustrated Vol.1 The protocols, Prentice Hall, 1994