Computer Networks Design and Management

Academic Year: (2020 / 2021)   **Review date: 03-07-2020**

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

Students acquire the following skills:

BASIC SKILLS
Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context
That the students know how to apply the acquired knowledge and their problem-solving capacity in new or little-known environments within broader (or multidisciplinary) contexts related to their area of ¿¿study
That students know how to communicate their conclusions and the latest knowledge and reasons that support them to specialized and non-specialized audiences in a clear and unambiguous way.
That students possess the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.

GENERAL COMPETENCES
Ability to project, calculate and design products, processes and facilities in all areas of Computer Engineering.
Ability to manage works and installations of computer systems, complying with current regulations, ensuring quality of service.
Ability for mathematical modeling, calculation and simulation in technology and business engineering centers, particularly in research, development and innovation tasks in all fields related to Computer Engineering and related multidisciplinary fields.
Ability to start, direct and manage the manufacturing processes of computer equipment, guaranteeing safety for people and goods, the final quality of products and their approval.
Ability to apply acquired knowledge and solve problems in new or little-known environments within broader and multidisciplinary contexts, with the ability to integrate knowledge.
Ability to know how to communicate (orally and in writing) the conclusions - and the ultimate knowledge and reasons that support them - to specialized and non-specialized audiences in a clear and unambiguous way.
Ability for continuous, self-directed and autonomous learning.

SPECIFIC COMPETENCES
Ability to integrate technologies, applications, services and systems typical of Computer Engineering, with a general character, and in broader and multidisciplinary contexts.
Ability to model, design, define architecture, implement, manage, operate, administer and maintain applications, networks, systems, services and computer content.
Ability to understand and know how to apply the operation and organization of the Internet, new generation network technologies and protocols, component models, intermediary software and services.
Ability to design, develop, manage and evaluate certification and security guarantee mechanisms in the treatment and access to information in a local or distributed processing system.
Ability to analyze the information needs that arise in an environment and carry out in all its stages the process of building an information system.
Ability to design and evaluate operating systems and servers, and applications and systems based on distributed computing.
Ability to understand and apply advanced knowledge of high performance computing and numerical or

computational methods to engineering problems.
Ability to design and develop computer systems, applications and services in embedded and ubiquitous systems.

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.
- AQM congestion control.
- DTN.
- 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. Performance optimization. Browser APIs and protocols. HTTP/3 and QUIC
- Multimedia communications protocols. RTP, RTCP, RTSP, SIP. Content distribution networks (CDN).
- Network management protocols.

LEARNING ACTIVITIES AND METHODOLOGY

FORMATION ACTIVITIES
Theorical class
Practical classes
Laboratory practices
Tutoring
Team work
Individual student work
Partial and final exams

TEACHING METHODOLOGIES
Presentations in the teacher's class with computer and audiovisual media support, in which the main concepts of the subject are developed and the bibliography is provided to complement the learning of the students.
Critical reading of texts recommended by the teacher of the subject:
Press articles, reports, manuals and / or academic articles, either for further discussion in class, or to expand and consolidate the knowledge of the subject.
Resolution of practical cases, problems, etc. ¿raised by the teacher individually or in groups
Exhibition and discussion in class, under the teacher's moderation of topics related to the content of the subject, as well as practical cases
Preparation of works and reports individually or in groups

ASSESSMENT SYSTEM

Practices and exercises: 60%.

Practices and exercises made in the lab will be evaluated.

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.

a. 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.

b. 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.

c. 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.

% end-of-term-examination: 40

% of continuous assessment (assigments, laboratory, practicals…):   60

BASIC BIBLIOGRAPHY

 - Dordal, Peter L. An Introduction to Computer Networks, edition 1.9.19 http://intronetworks.cs.luc.edu, 2019

 - 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