Communications networks and services

Academic Year: (2019 / 2020) **Review date: 07-05-2020**

Department assigned to the subject: Telematic Engineering Department

Coordinating teacher: CALDERON PASTOR, MARIA CARMEN

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

- Access Networks and Shared Media

OBJECTIVES

This course introduces the basic principles of communication networks and services (protocol architecture, routing, congestion control, etc.) showing by means of application to real networks. The main objective of this course is to analyse both architectural principles and the mechanisms that are required in order to exchange data between computers, work stations, servers and other data processing devices. To achieve this objective, the student must acquire specific knowledge and capacities.

Regarding the Program Outcomes (POs) of the degree, the course covers the following ones:
a) an ability to apply knowledge of mathematics, statistics, science, telecommunication technologies and engineering
b) an ability to design and conduct experiments, as well as to analyze and interpret data
e) an ability to identify, formulate, and solve engineering problems
j) a knowledge of contemporary issues
k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Regarding knowledge (PO j), at the end of the course the student will be able to:
- Understand the network concept and the different types of existing networks
- Understand the Internet network layer, IPv4: know the datagram format and the addressing model. ARP. ICMP.
- Understanding the IPv6 protocol: header format and addressing.
- Understand basic address management tools, NATs and DHCP.
- Understand routing protocols and algorithms.
- Understand Internet routing protocols by means of an example: RIP.
- Understand Internet transport layer: TCP and UDP.

Regarding capacities, they can be classified in two groups, specific capacities and generic capacities (or skills).

Specific capacities:
a) Define the IP addressing (IPv4 and IPv6) for a certain network. Design that network architecture. Properly configure the network layer of the different hosts. Properly configure the routers to support the communication of local area networks. (POs a, b, e, k)
b) Understand routing protocols. (POs a, b, e, k)
c) Understand and configure NATs. (POs a, e, k).
d) Understand and analyse TCP behaviour in diverse situations, scalability, interactive traffic, congestion. (POs a, e, k)

Skills:
- Overview of the complex problem of network communications, using the layer model approach. (POs a, k)

- Skills to work in teams to achieve the considered designs and configurations, properly balancing the work to face complex problems. (POs b, e)
- Skills to access and understand technical bibliography both in English and Spanish.
- Contact with wide spread technologies used in the professional world. (PO j)
- Skills to access the require information so as to know the details of a certain configuration.

DESCRIPTION OF CONTENTS: PROGRAMME

This is a course on communications through the Internet where basic technologies to interconnect different computers are studied.

The programme is divided in three parts:
FIRST PART: Introduction to computer networks and Internet.
- I.1 Network concept and types.
- I.2 Internet structure.

SECOND PART: Network layer
- II.1 Basic network layer concepts.
- II.2 IPv4 introduction: IPv4 header, fragmentation, ICMP.
- II.3 IPv4 addressing: IP network design, IP address management, DHCP, NAT, motivation for IPv6.
- II.4 IPv4 over Ethernet, ARP.
- II.5 Introduction to IPv6: header format, addressing, Neighbor Discovery.
- II.6 Network routing: distance vector protocols, links state protocols and path vector protocols. Dijkstra and Bellman-Ford algorithms.
- II.7 An Internet routing protocol: RIP.

THIRD PART: Transport layer
- III.1 Basic transport layer concepts.
- III.2 UDP.
- III.3 TCP: segment structure, connection management, congestion control.

LEARNING ACTIVITIES AND METHODOLOGY

The teaching methodology based on active learning will include:
(1) Lectures. The course has a basic reference book (see bibliography). The student will know exactly what are the learning objectives for every class and where in the reference book can they be located. Additional questions will also be provided to test the knowledge acquired after this study. In the group classes the concepts related to the learning objectives will be reviewed interactively with students participation. The course will also propose complementary bibliography to allow students to complete and detail particular chapters. (POs a, j)
(2) Laboratory classes where students will set up router and host configurations and where network and transport layers will be analysed. (PO b, k)
(3) Guided use cases resolution in small groups to help students acquire the required skills. (POs e, k)
(4) Exercises and study case solved by students as personal work so that they will be able to auto-evaluate acquired skills. (POs e, k)
(5) Group discussion of homework that will allow to develop the skill of analysing and communicating the relevant information so as to solve problems. (POs b, k)

ASSESSMENT SYSTEM

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

Evaluation: 100% continuous evaluation.

The final exam in the ordinary term will be only for those students that are not following the continuous evaluation. This exam will be assigned a maximum of 60% of the total mark.

The extraordinary evaluation will be by means of an exam (100% of the mark)

The continuous evaluation mark will be obtained from:

1) Knowledge tests (4) and lab test (1) done during the semester: 90% of the continuous evaluation mark [Assess POs a, b, e, j, k].

2) Deliverables from the 4 lab practices (preparation exercises, reports, milestones): 10% of the continuous evaluation mark [Assess POs a, b, e, j, k].

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- J. F. Kurose, K. W. Ross Computer Networking, a top-down approach; 5th edition, Pearson ¿ Addison Wesley, 2009.

ADDITIONAL BIBLIOGRAPHY

- Andrew Tanenbaum Computer Neworks; 4ª Edición, Prentice Hall, 2003.

- Dimitri P. Bertsekas Data networks, Prentice-Hall International, 1992.

- Iván Vidal, Ignacio Soto, Albert Banchs, Jaime Garcia-Reinoso, Ivan Lozano, Gonzalo Camarillo Multimedia Networking Technologies, Protocols, & Architectures, Artech House, 2019

- Mischa Schwartz Telecommunication networks, protocols, modeling and analysis, Addison-Wesley, 1987.

- Rick Graziani IPv6 Fundamentals: A Straightforward Approach to Understanding IPv6, Cisco Press, 2012

- W. Richard Stevens TCP-IP illustrated, Addison-Wesley, 1996.

- William Stallings Data and Computer Communications, Prentice Hall International, 2001.

- Ying-Dar Lin, Ren-Hung Hwang, Fred Baker Computer Networks: An Open Source Approach, McGraw-Hill, 2011