

Academic Year: ( 2022 / 2023 )

Review date: 31-05-2022

Department assigned to the subject: Department of Telematic Engineering

Coordinating teacher: GRAMAGLIA , MARCO

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

**REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)**

- + Calculus I
- + Statistics

**OBJECTIVES**

Along this course, the students will acquire basic knowledge on computer networks in general and Internet in particular, focusing on analyzing specific procedures in the access networks and shared media. In order to achieve this objective, students must acquire a set of knowledge and abilities.

Regarding the set of knowledge, at the end of the course the student must:

- + Knowledge of network computer architectures.
- + Understand functionalities developed by different actors in a network.
- + Knowledge of basic access networks architectures commonly used: PSTN, ISDN, ADSL, etc.
- + Knowledge of the structure of a physical layer standard.
- + Knowledge of design a structured cabling system.
- + Study in depth of the link layer techniques, analyzing their performance and usability criteria.
- + Understanding of shared media techniques for access networks analyzing the performance for different techniques and identifying the best technique for a given scenario.
- + Understanding of common link layer protocols: HDLC, PPP and SLIP.
- + Study several techniques used in LAN (Ethernet/IEEE 802.3, WLAN/IEEE 802.11) as well as VLAN concepts.

Regarding abilities, it is possible to classify them in two different groups: specific abilities and generic abilities or skills. Regarding specific abilities, at the end of the course, the student will be able to:

- + Design, connect and interconnect an Ethernet local area network, forming physical and logic networks.
- + Analyze the performance of several shared media techniques.
- + Analyze the performance of several communication systems.

Regarding generic abilities or skills, during the course we will work on:

- + The abstract model of layers used in network protocols architecture, which provides a wide view in order to tackle the complex problem of the communications networks.
- + Ability to work as a member of a team in order to develop proposed designs and configurations, balancing the load of work in order to face complex problems.
- + Knowledge about the different network standardization process.
- + Ability to apply knowledge of mathematics, statistics, computer science, and engineering as it applies to the fields of computer hardware and software.
- + Ability to identify, to formulate, and to solve hardware and software problems using engineering principles.
- + Recognition of the need for an ability to engage in lifelong learning, and an ability to independently acquire and apply required information.
- + Knowledge of contemporary issues.

**DESCRIPTION OF CONTENTS: PROGRAMME**

This is an introductory course on network protocol and architectures, starting on physical and data link layer within network protocol architecture, focusing on the access to the media techniques and examples of access network technologies. Both shared and point-to-point network protocols are included.

The program is divided in four modules:

## 1. Introduction

This module has the goal of defining basic concepts and to specify the general context as the foundation for following modules and for additional courses related with network protocols. Particularly, this module focuses on communication protocol architectures, using as examples most commons, like the OSI and TCP/IP models. This module includes an overview of some well-known and very used communication networks like the Switched Telephony Network, ISDN and Internet.

## 2. Physical Layer

This module is focused on the physical layer, and all topics related with it, like functionalities of the physical level, types of cabling used nowadays and their functionality characteristics. Some standards will be studied in order to comprehend all these characteristics. Furthermore, the Structured Cabling System will be studied based on several examples of use.

## 3. MAC layer

The main objective of this module is to study all topics related with the data link layer, going deeper on all necessary mechanisms to provide flow control, error control (FEC and ARQ techniques) and the definition and evaluation of all techniques used to share media on access networks, mainly.

### 3.1. MAC level functions

### 3.2. Frame limits

### 3.3. Error detection and correction

### 3.4. Congestion control

### 3.5. ARQ Protocols

### 3.6. Medium access protocols

### 3.7. Examples: HDLC and Ethernet

## 4. Network interconnection

The last module has the goal of study common technologies for local area networks. Particularly, we will focus on ETHERNET (IEEE 802.3) and Wireless LAN (IEEE 802.11) analyzing their architectures, addressing, basic characteristics, deployment scenarios and dimensioning. Furthermore, we will study other topics like the internetworking between local area networks, their design and criteria.

## LEARNING ACTIVITIES AND METHODOLOGY

The methodology includes:

1. Aggregated Classes, where basic concepts are introduced and where the professor explains the mechanism to develop each topic. These classes are aimed to focus the students on the comprehension, differentiation, classification and relationship of different concepts that will be described during the course.
2. Small Classes, which are mainly practical classes related with each of the modules, including the approach and resolution of exercises, works in labs, examples description, use cases, etc. In these classes the students have to generate, gather and combine all the concepts necessary to solve problems and to apply different criteria to select, design and develop technologies for a given proposed scenario.
3. Homework, where the students have to search, read and acquire basic information for each topic of the course, which will help them to better understand more advanced topics that will be explained during the aggregated classes. Furthermore, the students have to solve basic problems both individually and within work groups. This activities will be drive by the teachers following the chronogram of the course and providing different material to the student to help them with these activities.

## ASSESSMENT SYSTEM

Students have two calls to pass the course:

- 1) First call. This call is based on continuous assessment plus a final written exam.
- 2) Second call. This mechanism will be performed in June, and it will be based on a written exam.

**% end-of-term-examination:** 60

**% of continuous assessment (assignments, laboratory, practicals...):** 40

## BASIC BIBLIOGRAPHY

- B. Forouzan Transmisión de datos y redes de comunicaciones, McGraw-Hill, 2006 (4ta edición)
- Rich Seifert and Jim Edwards The All-New Switch Book, Wiley.

#### ADDITIONAL BIBLIOGRAPHY

- Andrew Tanenbaum Computer Networks, Prentice Hall.
- William Stallings Data and Computer Communications, Pearson, 2009 (8va edición)