Escuela Técnica Superior de Ingeniería

GENERAL SPECIFICATIONS

COURSE 23/24

Subject Data			
Name:			
Fundamentos de Redes de Computadoras			
English name:			
Computer Network Fundamentals			
Code:		**Type:**	
606010203		Mandatory	
Hours:			
	Total	In class	Out class
Time distribution	150	60	90
ECTS:			

Standard group	Small groups			
	Classroom	**Lab**	**Practices**	**Computer classroom**
	4	0	2	2

Departments:	Knowledge areas:
Ingeniería Electrónica, Sistemas Informáticos y Automática (Electronic, Computer Systems and Automation Engineering)	Ingeniería de Sistemas y Automática (Systems' Engineering and Automation)
Ingeniería Electrónica, Sistemas Informáticos y Automática (Electronic, Computer Systems and Automation Engineering)	Tecnología Electrónica (Electronic Technology)
Year:	**Semester**
2nd	1st

TEACHING STAFF

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Others Data (Tutoring, schedule...)

PhD Antonio J. Tallón Ballesteros *(PhD Lecturer, Accredited for Senior Lecturer)***:**

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SPECIFIC INFORMATION OF THE COURSE

1. Contents description:

1.1 In English:

- Communication media and systems.
- Communication Protocols. Stacks: OSI, TCP/IP, Ethernet.
- Planning and cabling networks.
- Configuring and testing networks.
- Network supervision and traffic analysis.

1.2 In Spanish:

- Dispositivos y medios de comunicación.
- Funciones y características de los protocolos de comunicaciones. Pila OSI, TCP/IP, Ethernet.
- Diseño de redes y cableado estructurado.
- Configuración de equipos.
- Técnicas de supervisión de redes y análisis de tráfico de datos.

2. Background:

2.1 Situation within the Degree:

The course Computer Network Fundamentals is lectured in the 2nd year of the Undergraduate Degree in Computer Science Engineering. This course builds a knowledge base from scratch in the topic of Computer Networks which will be extended in the courses "*Interconexión de Redes*" (3rd year), "*Administración y Redes de Computadores*" (3rd year), "*Redes Avanzadas de Computadores*" (4th year) and "*Seguridad de Sistemas Informáticos*" (4th year). Passing this course means that a skill to design and setup networks is acquired with the goal to labor market.

Its content is integrated in the CCNA 1 Exploration (Cisco Certified Network Associate) curriculum which lectures the CISCO Lecturing Centre in the University of Huelva. This curriculum provides the students the required skills to get the first out of the four milestones in the CCNA certification. The further milestones can be completed in the following related courses in the upper years.

2.2 Recommendations

Although no previous knowledge is required, may be of utility certain domain of concepts tied to waves' study (basic electromagnetism and Fourier decomposition). Basic ideas on operating systems, programming and the usage of the more basic internet services (browser and mail) are also recommendable.

3. Objectives (as result of teaching):

To know determining the OSI, the TCP/IP and the IEEE 802 project's layers; and to understand the encapsulation information procedure that takes place among them.

To know the physical aspects of the different network technologies and understand the most relevant problems which happen in the data communication.

To know distinguishing the concepts and identify the involved elements in a data link.

To understand the reasons for the logical networks creation as well as the communication processes among different networks types by means of the suitable devices.

To acquire the underlying fundamentals in the data transport process both reliable and non-reliable.

To know the functionality and the operation of the main applications which are used at application layer level.

To know designing, installing, configuring and fixing a local network.

4. Skills to be acquired

4.1 Specific Skills:

CC01: Skill to design, develop, select and assess application and computer science systems, ensuring its reliability, security and quality, according to ethic principles and to the current regulations.
C02: Skill to schedule, conceive, deploy and lead computer science projects, services and systems in all the scopes, managing its starting and its continuous improvement and assessing its economic and social impact.
CC05: Knowledge, administration and management of computer science systems, services and applications.
CC11: Knowledge and application of the features, functionalities and structure of the Distributed Systems, the Computer Networks and Internet and to design and implement application based on the previous three elements.

4.2 General, Basic or Transversal Skills:

CB1. Demonstrate to understand and have acquired knowledge about an area of study that starts from basic Secondary Education, and is often at supported by advanced textbooks, but also includes some aspects that involve knowledge related to the forefront of their field of study.
CB5. Develop the learning skills required to undertake further studies with a high degree of autonomy.
CG01: Organization and scheduling as well as information management skill.
CG03: Solving problem skill.
CG05: Team-work skill.
TC2. Develop a critical attitude, being able to analyze and synthesize.
TC3. Develop an attitude of inquiry that permanently enables to review and deepen in the knowledge.
TC4. Acquire Computer and Information Skills (CI2) and apply them working.

5. Training Activities and Teaching Methods

5.1 Training Activities:

- Theory sessions on the program contents.
- Problem solving sessions.
- Practical sessions in specialized laboratories or in Computer Science rooms.
- Faculty-guided academic activities (FGAAs): seminars, keynotes, work developments, discussions, collective tutorials, assessment and self-assessment activities.

5.2 Teaching Methods::

- Participative lecture.
- Development of Practices in Specialized Laboratories or Computer Science Rooms in small groups.
- Problem solving and practical exercises.
- Individual or collective tutorials. Direct feedback faculty-students.
- Setting out, carrying out, follow-up and introduction of works.
- Assessments and exams.

5.3 Development and Justification:

- 1.5 hours theoretical sessions in which the thematic concepts will be explained.
- Sessions for setting up and solving problems by the student and final presentation in the blackboard.
- Practical activities in the laboratory oriented to the application of theory-learnt concepts and to the development of new skill and common techniques in the computer networks' field.
- Development of a network team-project.
- Possibility of achieving the CISCO's SYSTEMS CCNA certification in design, setting and maintenance of computer science networks and computers: CCNA 1. Network Fundamentals.

6. Detailed Contents

CHAPTER 1. BASIC FOUNDATIONS

1.- Introduction.
2.- Network architecture.
2.1.- Transferred information units in the communication.
2.2.- The OSI reference model from ISO.
2.3.- The TCP/IP reference model.
2.4.- Comparison between the OSI and TCP/IP models.
3.- Standards and Normalization agencies.
3.1.- Organizations of standardization in communications.
3.2.- International normalization agencies.
3.3.- Norms on Internet.

CHAPTER 2. TRANSMISSION TECHNOLOGIES IN DATA NETWORKS

1.- Introduction.
2.- Analysis of signals.
2.1.- Basic definitions.
2.2.- Fourier analysis.
2.3.- Transmission perturbations.
2.3.1.- Channel attenuation.
2.3.2.- Bandwidth.
2.3.3.- Delay distortion.
2.3.4.- Noise.
2.4.- Channel features depending on the medium properties.
2.4.1.- Transmission speed.
2.4.2.- Channel capacity.
2.5.- Modes of signal transmission.
2.5.1.- Modulation with analogic carrier.
2.5.2.- Modulation with digital carrier.
2.5.3.- Data digital encoding in base band.
3.- Transmission media.
3.0.- Power line communications (PLC).
3.1.- Twisted pair.
3.2.- Coaxial cable.
3.3. Optical fiber.
3.4.- Transmission by optical path.
3.5.- Links by radio and microwaves.
3.6.- Communication via satellite.
3.7.- Infrared communication.
3.8.- Light-Fidelity communication (Li-Fi).
4.- Data transmission systems.
4.1.- Serial and parallel communication. Definitions of asynchronous, synchronous and plesiochronous transfer. PDH and SDH. RS-232 serial communications.
4.2.- Multiplexing techniques.

CHAPTER 3. DATA LINK CONTROL SYSTEMS

1.- Introduction.
2.- Addressing.
3.- Control of transmission and dataflow.
3.1.- Flow control
3.2.- Stop-and-wait protocol.
3.3.- Sliding window protocol.
4.- Error control.
4.1.- Error detection.
4.1.1.- Horizontal and vertical parity.
4.1.2.- Checking by sum: checksum.
4.1.3.- Cyclic redundancy codes (CRC).
4.2.- ARQ Protocols.

5.- Performance analysis.
6.- High-level data link control (HDLC)

CHAPTER 4. LOCAL AREA NETWORKS

1.- Introduction.
1.1.- Topologies of the local networks.
1.2.- Static assignment of the channel.
1.3.- Dynamic assignment.
1.4.- IEEE 802 norm for Local Networks.
2.- Ethernet and 802.3.
2.1.- Topologies of the Ethernet network.
2.2.- Format of Ethernet 802.3 frames.
2.3.- Architectures of Ethernet networks.
4.- Other LAN protocols (Token Ring, Token bus...).
5.- Wireless networks. IEEE 802.11.
5.1.- Types of devices.
5.2.- Introduction to the security.

CHAPTER 5. INTERCONNECTION OF NETWORKS.

1.- Introduction.
2.- Network level. The IP protocol.
2.1.- IP addresses.
2.1.1.- Network and broadcast addresses.
2.1.2.- Decimal notation with dots.
2.1.3.- Byte-order in the network.
2.2.- The IP datagram.
2.3.- The new version of the IP protocol: IPv6.
2.4.- The ARP protocol.
2.5.- RARP Protocol.
2.6.- ICMP protocol: error and control messages.
3.- Transport level.
3.1.- The UDP protocol.
3.1.1.- UDP message format.
3.1.2.- Booked numbers for UDP ports.
3.2.- The TCP protocol.
3.2.1.- The sliding window of the TCP protocol.
3.2.2.- Flow control.
3.2.3.- TCP ports.
3.2.4.- TCP segment format.
3.2.5.- Acknowledgments and retransmissions.
3.2.6.- Establishment and release of a TCP connection.
3.2.7.- Forced send of data.
3.2.8.- Booked numbers for TCP ports.

CHAPTER 6. WIDE AREA NETWORKS.

1.- Introduction.
2.- Circuit-switched networks.
2.1.- Analogic phone lines (RTB).
2.2.- ISDN.
3.- Packet-switched networks.
3.2.- Frame Relay.
3.3.- ATM.

PRACTICE PROGRAMME:

PRACTICE 1: BASIC CABLING OF NETWORKS
PRACTICE 2: USAGE OF THE FLUKE DSP-4000 WIRING ANALYZER.
PRACTICE 3: USAGE OF A NETWORK SIMULATOR (PACKET TRACER).
PRACTICE 4: BASIC NETWORK CONFIGURATION AND COMMANDS.
PRACTICE 5: TRAFFIC ANALYSIS WITH WIRESHARK.
PRACTICE 6: INTRODUCTION TO THE CISCO ROUTERS CONFIGURATION.

7. Bibliography

7.1 Basic Bibliography:

- Official lecture notes of the course (available in Moodle).

7.2 Additional Bibliography:

ANEXO I

- William Stallings, Comunicaciones y redes de computadores, Séptima edición, Pearson Educación, 2004.

- Behrouz A. Forouzan, Transmisión de Datos y Redes de Comunicaciones, segunda, edición, Mc.Graw-Hill, 2002.

- Andrew S. Tanenbaum, Redes de computadoras (4ª edición). Prentice Hall, 2003.

- Kurose, James F. and Ross, Keith W., Computer Networking: A Top-Down Approach Featuring the Internet (3rd Edition), Addison Wesley, 2005.

- Coomer, Douglas E., TCP/IP Principios básicos, protocolos y arquitectura (3ª Edición). Prentice Hall, 1996.

- Cisco, Guía del primer año CCNA 1 y 2 , Pearson Educación.

- Redes de computadoras y arquitecturas de comunicaciones. Supuestos prácticos. Ed. Pearson.

8. Systems and Assessment Criteria

8.1 System for Assessment:

- Problems / theory exam.
- Practice presentation.
- Work presentation and essays.
- Individual student monitoring.

8.2 Assessment Criteria and Marks:

8.2.1 Examinations Convocatory 1

CONTINUOUS ASSESSMENT
Minimum requirements to pass in continuous assessment:
- To do a work in groups to design a local network with the quality criteria specified by the lecturer.

 - To attend the practical classes with a maximum of two non-justified no-shows.

- To complete the practices, showing the results or handing a technical paperwork (memory) when required and fixing the indicated errors noticed by the lecturer.

 - To pass the final theoretical exam.

The continuous assessment of the student will depend on:

- The practices' assessment which will be based in the handed memories, the completed percentage and/or oral questions.

- The assessment of the network-design work which is considered, in terms of scoring, an additional practice which a double weight.

- The mark of the theoretical exam scheduled at the end of the four-month period. This exam will be based in the class-lectured theoretical contents and will have questions and problems. The student will have two hours to complete it and he/she may only need a scientific calculation and a pen.

- The individual student follow-up by means of the developed-activity assessment during the lectures. It will comprise questions, exercises and faculty-guided academic activities, in general.
- In order to do the weighted sum it will be an essential requirement to pass the theoretical part and the exam in an isolated way.

The final mark on the record for the continuous assessment will be
 (p = assessment of the participation in class (FGAA). $0<p<1$):
Final mark = $(0.5+0.2 \times (1-p))$ x Theoretical mark + 2 x p + 0.3 x Practices' mark.

Hence, the percentages are distributed as follow: Practices = 30%, Student follow-up = 0% - 20%, Theoretical exam = 50% - 70%, where the exact percentage will depend on the participation in class of each student.

HONORS
The conditions to get honors are as follow: to get the maximum mark in the practical part, the class activities and the theoretical exam. If there were several candidates, an oral test will assess to which extent the lecture contents in the course are exceeded.

Competences assessment
With the exam and class marks are assessed the competences: CC01, CC11, CB1, CB5 and G03.

With the practices are assessed the competences: CC02, CC05, G01, G03, G05 and T01.

8.2.2 Examinations Convocatory II

The assesment will be done using the same procedure described in the convocatory I. The practical part mark will be saved for this convocatory if it was passed in the convocatory I.

People who did not pass the laboratory in the previous convocatory, must attend and pass a practical exam including exercises with a similar complexity to the items worked in the laboratory syllabus.

8.2.3 Examinations Convocatory III

The assesment will be done using the same procedure described in the convocatory I. The practical part mark will be saved for this convocatory if it was passed in the convocatory I.

People who did not pass the laboratory in the previous convocatory, must attend and pass a practical exam including exercises with a similar complexity to the items worked in the laboratory syllabus.

8.2.4 Extraordinary Convocatory

The assesment will be done using the same procedure described in the convocatory I. The practical part mark will be saved for this convocatory if it was passed in the convocatory I.

People who did not pass the laboratory in the previous convocatory, must attend and pass a practical exam including exercises with a similar complexity to the items worked in the laboratory syllabus.

8.3 Single Final Evaluation:

The students which opt for the single final assessment in any of the exam calls (calls I, II, III and extraordinary to complete the undergraduate degree) have to do a theoretical exam with the same features of the previous section and besides:

a) If they completed the practices in this academic year, the assessment will only depend on this exam

b) If they did not complete the practices or failed them, they have to do an additional practice test which will assess the knowledge involved in the proposed practices' description. The assessment will only depend on this exam. This test can be done either in the laboratory or being written. It will consist of cases' study whose solving implies the equipment setting. It will last one hour. The student will not need any material, with the exception of a pen. The mark on the record will be a 70% of the theoretical exam and 30% of the practical test, with the restriction of passing both independently.