Communications technologies for a connected society

Academic Year: (2022 / 2023) **Review date: 14/12/2022 19:01:13**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: GONZALEZ SERRANO, FRANCISCO JAVIER

Type: Compulsory ECTS Credits : 6.0

Year : 4 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

1. Access Networks and Shared Media.
2. Digital Communications.

OBJECTIVES

The main objective of this course is to provide the student with an overview of the different communication technologies for the connected society, with special emphasis on aspects related to digital communications: physical and link layers (logical control and medium access). To achieve this objective, the student must acquire a series of technical knowledge and skills.

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

1. Understand the relevance of broadband networks, as well as their main actors and services.
2. Know the most relevant characteristics of the different physical access media used today.
3. Have an overview of the main communications technologies associated with each transmission medium.
4. Understand the transmission mechanisms at the physical level, access to the medium and logical control used in each case and the reasons for their use.
5. Know the main details of the most relevant communication technologies for the connected society.

Regarding the capacities, during the course they will work on:

1. The application of the technical knowledge acquired in other subjects related to digital communications and communications networks to the analysis of network access technologies.
2. Teamwork, assuming a certain role and associated responsibilities.
3. The identification and resolution of problems related to the physical and link layers.
4. Efficient and effective communication of technical information.
5. The recognition of the need for continuous learning, obtaining the necessary information to deepen specific aspects of a certain technology already studied or analyze a technology not studied from different bibliographic sources: web pages, books, technical reports, articles, standards, etc. Critical analysis and contrast of the information obtained.
6. Knowledge of the main current communication networks and the most important access technologies to them.

DESCRIPTION OF CONTENTS: PROGRAMME

The programme is divided in 16 topics grouped together in 4 large blocks:
Block 1: Introduction.
1. Introduction to broadband networks and access technologies.
2. Broadband services and applications.
Block 2: Wired Broadband Access Technologies.
3. Digital subscriber loops (xDSL).
4. Hybrid optical fiber and cable networks (HFC).
5. Passive optical fiber networks (PON).
Block 3: Wireless Broadband Access Technologies.

6. Wireless Local Access Networks
7. Broadband Mobile Communication Networks
8. Satellite Communication

Block 4: Technologies for the Connected Society

9. Internet of Things
10. Short-range Access Networks: NFC, RFID, Bluetooth, Zig-bee, UWB, 802.15.6. Wearables.
11. Technologies for Remote Areas: HAPS, Balloons, Drones
12. Technologies for disaster and security critical areas: TETRA; Military Networks.
13. Technologies for Intelligent Transport Systems: Vehicular networks: V2V, V2I; 802.11p
14. Technologies for Smart Cities/Buildings/Homes:

- LPWAN, SigFox, LoRa, NB-IoT
- Sensor Networks

15. Technologies for eHealth
16. Emerging Technologies: 5G, HetNEts, LIFI

LEARNING ACTIVITIES AND METHODOLOGY

The learning activities are the following:

1. Master classes. Presentation of the main concepts of each topic. Discussion and clarification of general questions about the concepts acquired by the students during the self-learning process. To facilitate the development of this activity, students will have a set of transparencies and bibliographic references.

2. Team Project. Starting from an application scenario or the needs of the customers/users, the student teams will analyze alternatives and propose a practical solution. The practical sessions will be developed in the form of "collective tutorials" and sessions to clarify doubts.

3. Individual tutorials. Clarification of particular doubts about specific concepts.

4. Preparation of Technical Reports. To evaluate the practices, the students, configured in teams, will prepare a technical report in which they detail the proposed solution for the considered application/scenario.

5. Oral Presentation. Students will make two presentations throughout the course. In the first, they will describe the application scenario, obtain a series of requirements/customer needs, and propose various solutions that must be assessed and compared (Preliminary Design Review). In the second, at the end of the course, they will detail the technical aspects of their solution, and will specify its parameters/dimensions according to the actual customer needs (Critical Design Review)

6. Final Exam. Test in which the level of knowledge of the students will be assessed.

ASSESSMENT SYSTEM

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

The work of the students will be evaluated through a continuous evaluation system using several indicators: group exercises collected in class, short theoretical exams performed after each major block, group theoretical technical report, and technical report and presentation about the laboratory experiments.
The precise scoring used will be the following:

1. General exam at the end of the term: 40%.
   - Minimum Passing Score: 5 out of 10 points.
2. Group project on a communication technology:
   - Technical report: 30 %.
   - Oral presentation: 20 %
   - Development of a simulation tool and laboratory practices: 10%

BASIC BIBLIOGRAPHY

- Devaki Chandramouli, Rainer Liebhart, Juho Pirskanen 5G for the Connected World, WILEY, 2019

- Rodolfo I. Meneguette, Robson E. De Grande, Antonio A. F. Loureiro Intelligent Transport System in Smart Cities: Aspects and Challenges of Vehicular Networks and Cloud (Urban Computing) , Springer, 2019

- Vlasios Tsiatsis, Stamatis Karnouskos, Jan Holler Internet of Things: Technologies and Applications for a New Age of Intelligence, Academic Press, 2018

ADDITIONAL BIBLIOGRAPHY

- Anna Maria Vegni, Dharma P. Agrawal Cognitive Vehicular Networks, CRC Press, 2016

- Burak Kantarci, Sema Oktug Wireless Sensor and Actuator Networks for Smart Cities, MDPI AG, 2018

- Mohamed Gado, Doaa Abd El-Moghith Li-FI Technology for Indoor Access: Li-Fi, LAP LAMBERT Academic Publishing, 2015

- Syed A. Ahson, Mohammad Ilyas Near Field Communications Handbook, Auerbach Publications, 2011