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Mobile Wireless Networks

Academic Year: (2022 / 2023)   **Review date: 09-05-2022**

Department assigned to the subject: Telematic Engineering Department

Coordinating teacher: OLIVA DELGADO, ANTONIO DE LA

Type: Electives ECTS Credits : 3.0

Year :   Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Communications Networks and Services and Switching

OBJECTIVES

This course describes the principles of Networks with wireless access technologies, and the implications that the special features that this type of access (for example, mobility of users) have in the network protocols. 4G and its evolution (5G), and the technology IEEE 802.11 (WiFi) will be analysed. 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
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 specific characteristics of the wireless access and the impact of mobility.
- Understand the standards IEEE 802.11, including aspects related to QoS and security.
- Understand the 4G: standardization process, architecture, protocols, and service provisioning.
- Understand the future architecture of the mobile networks: EPS.
- Understand the future 5G networks and the relevant technologies (virtualization, C-RAN and MEC).

SPECIFIC CAPACITIES:
- Work with the main technologies in the field of mobile communication networks, understanding their components and functionalities (PO j).
- Design and configure mobility solutions in IP networks to support a group of mobile users (POs a, k).
- Configure equipment based on IEEE 802.11 technologies, understanding advanced configuration options (POs b, k).
- Design and configure a wireless access solution to support mobile users (PO b).
- Design cellular communications networks architectures (PO a).

SKILLS:
- A global view of the complex problem of the communications in networks with mobility and wireless access (POs a, k).
- To work in teams, properly distributing the work to face complex problems (PO b).
- To access and understand technical bibliography.
-Contact with widespread technologies used in the business and operator 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 wireless and mobile communications course, which covers and analyzes the implications that the particular characteristics of these types of networks have on the different protocols used in the networks.

The programme is divided into 3 parts:

PART ONE (Introduction): Introduces the problem of wireless networks and gives a brief introduction to the physical layer.

PART TWO (WiFi): Introduction to the IEEE 802.11 specification family. Control of access to the medium in IEEE 802.11. Advanced technologies in IEEE 802.11.
PART THREE (4G): Introduction to the 4G system and its evolution towards 5G.

LEARNING ACTIVITIES AND METHODOLOGY

The teaching methodology includes:

(1) Theoretical classes. Students will be provided with the learning objectives to be covered in which lecture and the specific material to prepare it (prior to the actual class). In these classes, the concepts related to the learning objectives are revised and, with the participation of the students, the acquired knowledge will be checked and strengthened interactively (POs a, j).

(2) Laboratory classes in computer rooms, where students will configure wireless communication nodes with mobility support, and also end devices. Using traffic supervision tools, students will also analyze the proper operation of the protocols (POs b, k).

(3) Exercise solving by the students, which will help them to auto-assess their level of knowledge and acquire the necessary abilities (PO k).

(4) In-class solution comparison and joint correction to the exercises, which should help to strengthen knowledge and develop the ability of analyze and communicate the information that is relevant in order to solve problems (POs b, k).

(5) Optionally, the student may carry out a technology development project on IEEE 802.11 or 4G.

ASSESSMENT SYSTEM

The evaluation will be 100% continuous evaluation (consisting of laboratories, final exam of continuous evaluation and project). If a student does not follow the continuous evaluation, he/she will be able to take the exam in the ordinary exam to obtain 60% of the grade. In the extraordinary call, the current regulations of the Universidad Carlos III de Madrid will be followed.

The grade of the continuous evaluation will be formed by two (+1 optional) blocks:
o Laboratory results (evaluation based on milestones and explanatory memories of the results; optionally, individual evaluation tests on the laboratory practices may be performed)[Evaluates POs b, k].
o Quiz on the content of the subject, carried out in week 14.
o Optionally, completion of a project (wiki-based evaluation with explanation of the project, code and conclusions): [Evaluate POs b, k].

Since the labs are updated every year, the weight of each part will be assessed according to the difficulty of the labs of that course.

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

BASIC BIBLIOGRAPHY

 - H. Holma, A. Toskala. LTE for UMTS: Evolution to LTE-Advanced., John Wiley and Sons, 2011

 - Matthew Gast. 802.11 Wireless Networks: The Definitive Guide, O'Reilly Media, 2009

 - Patrick Marsch, Ömer Bulakci, Olav Queseth, Mauro Boldi. 5G System Design: Architectural and Functional Considerations and Long Term Research., John Wiley and Sons, 2018

ADDITIONAL BIBLIOGRAPHY

 - null IEEE Standard for Information Technology¿ Telecommunications and Information Exchange between Systems Local and Metropolitan Area Networks¿ Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, IEEE, 2020
 - null TS 23.501, System Architecture (R17), 3GPP, 2022