Wireless and mobile networking

Academic Year: (2019 / 2020) **Review date: 03-05-2019**

Department assigned to the subject: Telematic Engineering Department

Coordinating teacher: BERNARDOS CANO, CARLOS JESUS

Type: Compulsory ECTS Credits : 6.0

Year : 4 Semester : 1

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. The traditional cellular communication networks (GSM) and their evolution (GPRS and UMTS), and the paradigms coming from the evolution of data networks (IEEE 802, Internet) to support mobility, 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 protocols to support mobility in IP networks.
- Understand the standards IEEE 802.11, including aspects related to QoS and security.
- Understand the role of the standard IEEE 802.21 to support technology independent handover control mechanisms.
- Understand the UMTS system and its evolution from GSM: 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 four parts:

FIRST PART (Introduction): The concept of wireless mobile networks is introduced. The different ways in which this functionality has been introduced into the communication networks are reviewed.
SECOND PART (Wireless networks): Introduction to the IEEE 802.11 networks. Mobility support in the IEEE 802.11 family. Medium access control in IEEE 802.11.
THIRD PART (Mobility in IP networks): Introduction to IP mobility. Introduction to IPv6. Mobile IPv6. Extensions to Mobile IPv6.
FOURTH PART (Cellular mobile communications): Introduction to the cellular mobile networks. Cellular mobile networks: GSM, GPRS and UMTS. Evolution of the cellular mobile networks: EPS. 5G networks: virtualization in mobile networks (SDN and NFV), C-RAN architectures and MEC.

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).

ASSESSMENT SYSTEM

The evaluation is 100% continuous assessment in the first evaluation, following the existing University regulation in the second evaluation.

The mark of the continuous assessment work is composed of three parts:

o Deliverables (questions, study cases, specific works assigned by the lecturers, and can also involve discussion with the students): 20% of the final mark [Evaluates POs a, j, k].
o Laboratory results (assessment based on milestones and written reports; optionally, individual tests might be performed): 35% of the final mark [Evaluates POs b, d, k].
o Knowledge exams (performed in class): 45% of the final mark [Evaluates POs a, b, j, k].

Laboratory exercises are not compulsory.

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

BASIC BIBLIOGRAPHY

- BATES, R. J. GPRS : general packet radio service, McGraw-Hill, 2002.
- CAMARILLO, G., GARCÍA-MARTÍN, M. A. The 3G IP multimedia subsystems: merging the Internet and the cellular worlds, 2nd ed. John Wiley, 2006.
- GAST, M. 802.11 Wireless Networks: The Definitive Guide, O'Reilly Media; 2 edition, 2005.
- KAARANEN, H. UMTS networks: architecture, mobility and services, John Wiley & Sons, 2005.
- KAPPLER, CORNELIA UMTS networks and beyond, John Wiley & Sons, 2009
- SOLIMAN, H. Mobile IPv6: Mobility in a Wireless Internet, Addison-Wesley Professional, 2004.

ADDITIONAL BIBLIOGRAPHY

- GEIER, J. Wireless LANs: implementing interoperable networks, Macmillan Technical Publishing, 1999.
- HOFFMAN, J. GPRS demystified, McGraw-Hill, 2003.

- PERKINS, CHARLES E. Mobile IP : design principles and practices , Addison-Wesley, 1998