Program	59EC – Communications Electronic Engineering B. Eng.

Course code and name	
Code	595040047
Name	Embedded Systems Design with Raspberry Pi
Semester	S6 [(February-June)]

Credits and contact hours	
ECTS Credits	4,5
Contact hours	45

Coordinator's name	Mariano Ruiz González [mariano.ruiz@upm.es]

Specific course information

Description of course content

This course introduces the students to the use of embedded electronic systems for practical application development. Students learn to develop and embed their own Linux-based operating system in a very low-cost embedded system like the Raspberry Pi during the course. The course is organized as laboratory assignments introduced by theory lessons. The laboratory assignments are designed to emphasize application development and integration skills and the presentation of results in an oral and written manner.

List of topics to be covered

1. Introduction to Raspberry Pi: Architecture and hardware resources
2. Raspberry Pi Linux Application development
    - 2.1. Raspberry Pi Operating System installation
    - 2.2. Linux essential use tutorial
    - 2.3. (Optional) Install and configure Ubuntu Virtual Machine
    - 2.4. Connecting sensors and actuators to Raspberry Pi
    - 2.5. C application development for Raspberry Pi
3. Generation of custom embedded Linux systems
    - 3.1. Embedded Linux System Fundamentals
    - 3.2. Embedded Linux System generation tools: Buildroot
4. Embedded Linux Application development
    - 4.1. Environment configuration for remote connection, development, deployment, testing, and debug
5. IoT Application development using Raspberry Pi and Embedded Linux
    - 5.1. IoT fundamentals: Protocols and use cases
    - 5.2. Raspberry Pi for IoT applications

Prerequisites or co-requisites	
- Microprocessors - Microprocessor-based Systems - Programming I and Programming II - Operating Systems - Basic computer networks knowledge	
Course category in the program	
☐ **R (required)**	☑ **E (elective)** *(elective courses may not be offered every year)*

Specific goals for the course
Specific outcomes of instruction
LO376.- Know the basic hardware features of an electronic system embedded as RaspBerry IP based on a System On Chip. LO377.- Identify the functionality of each of the digital and analog interfaces included in the RaspBerry-PI. LO378.- Install a Linux operating system and software applications in Raspberry Pi. LO 79.- Learn about the elements of a distribution of Linux for an embedded system. LO380 - Configure and build a distribution of the Linux operating system using the Buildroot for the RaspBerry-IP platform. LO381 - Connect a basic electronic circuit to one of the RaspBerry-IP digital interfaces. LO382 - Develop a basic software application using RaspBerry IP interfaces. LO383.- Document the development of an application with RaspBerry-PI and present it in public. LO384.- Present and defend in public proposed techniques to solve problems. LO385 - Write technical papers presenting the steps followed and the conclusions obtained in the implementation of an application.

Further reading and supplementary materials
– Moodle Web resources

Teaching methodology			
_X_ **lectures**	_ _ **problem solving sessions**	_X_ **collaborative actions**	_X_ **laboratory sessions**
Other:			