Foundations of Technology

Academic Year: (2018 / 2019) **Review date: 18-01-2019**

Department assigned to the subject:

Coordinating teacher: CASTRO GONZALEZ, ALVARO

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 2

OBJECTIVES

Students will learn the basic concepts of robotics, which are required to gain understanding in more complex areas.
They will be able to program a robot and develop applications that use sensors, actuators and a controller.
Students will acquire general programming notions that can be applied in other fields.
Students will learn the basic concepts related with sensor measurements and signal conditioning. These concepts also include amplification and analog circuit design.
Students will learn about basic concepts of Analog-to-Digital conversion.
Students will learn about Microcontrollers and its use in measuring instrumentation.

DESCRIPTION OF CONTENTS: PROGRAMME

Class 1: Introduction to robotics.
Definition of robots and classification. Presentation of basic concepts such as hardware and software, sensors and actuators, or controllers. What¿s the role of humans?
Class 2: Building our robot.
Students will get familiar with the robotic platform by assembling its components. Introduction to Arduino, the language of the robot.
Class 3: Programming the robot.
Students will learn how to read information from the sensors as well as commanding the different actuators. Implementation of the first controller, the robot¿s brain.
Class 4: Applications.
Line follower: based on the information provided by its sensors, students will program the robot to follow a line in the floor. Wall follower: a well-known strategy in robot navigation is to make the robot to follow the walls.
Class 5: Personal project 1.
Students will design and implement a new application for the robot. Discussion with the teacher and start working.
Class 6: Personal project 2.
Students will progress in the implementation of their personal project with the robot.
Class 7: Presentation of the final project and tour.
The first half of the class will be dedicated to the student presentations where they will explain their new robot application to the rest of the group. Finally we will visit the laboratories of robotics where students will have the opportunity to see, interact and understand the operation of state-or-the-art robots.
Class 8: Introduction to basic electronic for instrumentation.
Students will learn the basic concepts related with sensor measurements. Specially focus on signal conditioning. Students will study Instrumentation Amplifier AD620.
Class 9: Introduction to Analog to Digital conversion and signal processing.
Students will learn about basic concepts of Analog-to-Digital conversion. Also, students will learn basic concepts about signal processing, focus on signal reconstruction.
Class 10: Microcontroller (Arduino).
Students will learn how to use and program Arduino microcontroller. This device will be used for Analog-to-Digital Conversion and signal processing. Code examples on how to use the microcontroller will be shown.
Class 11: Temperature sensor.
Students will learn how to implement a system to measure temperature. First, students will learn to characterize the temperature sensor. Second, they will learn how to do the signal conditioning (temperature to voltage conversion) using instrumentation amplifier AD620. Finally, students will learn how to digitize the temperature magnitude (in voltage) using Arduino microcontroller.

Class 12: Lab class 1: Signal conditioning.
In this first lab class students will implement the sensor and instrumentation amplifier AD620. They will connect both devices to do the temperature to voltage conversion.
Class 13: Lab class 2: Microcontroller.
In this second lab class students will implement the software to use in the microcontroller. They also will connect the analog front-end with the Arduino microcontroller.
Class 14: Lab class 3: Complete system.
Students will connect the complete system (temperature sensor, amplifier and Arduino microcontroller) using Matlab. The code for Matlab will be given by the professor. Finally, students will characterize the system and will do a final report.

ASSESSMENT SYSTEM

Experimental work Robotics 50%
Experimental work Electronics 50%

BASIC BIBLIOGRAPHY

- Floyd, Thomas L. Electronic devices, Pearson Prentice Hall, 2008

- Roland Siegwart, Illah Reza Nourbakhsh and Davide Scaramuzza Introduction to autonomous mobile robots, MIT Press, 2011