RobotCraft 2019

4th Robotics Craftsmanship International Academy

A. Structure

Title

RobotCraft 2019: *4th Robotics Craftsmanship International Academy*

Dates

1st July to 2nd September 2019

Registration Fee

All applicants will be interviewed in an early stage of the application process. Only selected applicants will be able to conclude the registration process and attend the programme.

Category	***Early (Until 18th March 2019)***	***Regular (Until 20th May 2019)***
Higher Education Student	350€	425€
University of Coimbra Student* ***ESN Member****	300€	375€

* Requires the submission of a proof during the application process.

Disciplines:

Robotics; Mechanics; Electronics; Informatics.

Type of course:

Lessons (theoretical classes, seminars, workshops, etc.) (**T**): 84 hours (auditorium with all interns)
Laboratory (**L**): 36 hours (classroom with groups of up to 20 interns)
Open Laboratories (**O**): 27 hours (classroom with all interns)
Homework (**H**): 36 hours

Specific objectives

- To promote concepts and theorems for the introduction to robotics, describing the history of robotics and its evolution;
- To acquire basic electromechanical concepts, applied in the development of robotic platforms;
- To understand the potential use of Atmel microcontrollers, using the *Arduino* platform;
- To understand the potential use of the *ROS* framework;
- To acquire C/C++ programming skills;
- To understand the use of sensors (*e.g.*, range finders, encoders, cameras) and actuators (*e.g.*, servo motors, stepper motors, DC motors) used in robotics;
- To explore and apply the concepts of networks and different communications architectures to robotics;
- To explore and apply concepts of artificial intelligence in robotics;
- To consolidate concepts learned during the modules for the full design of a mobile robotic platform, including electromechanical assembly, low-level and high-level programming, and artificial intelligence;
- To validate the design of the mobile robot platform under a competitive scenario.

Attendance

Intern's attendance is assessed using the unique RFID cards used as individual identification.
To obtain the certificate, the intern must comply with the following attendance:

- Lessons (theoretical classes, seminars, workshops, etc.): 60 out of 84 hours
- Laboratory: 24 out of 36 hours (4 out of 6 week laboratories)*

* Attendance outside predefined laboratory days do not make up for missing laboratories.

B. Program content [1st July to 2nd September 2019]

Craft #1 (C1): Introduction to Robotics (4,5h T)

- Presentation of lecturers, mentors and interns (**T**);
- Presentation of **RobotCraft 2019** and the different crafts it comprises (**T**);
- Introduction to robotics, describing the history of robotics and its evolution (**T**);
- Presenting mobile robot morphologies, namely sensors and actuators (**T**);
- Brief literature review related to robotics, presenting the necessary basic theoretical concepts (**T**);

Craft #2 (C2): Introduction to Programming (16,5h T)

- Introduction to C/C++ programming (**T**).

Craft #3 (C3): Mechatronics (6h T | 6h L | 6h H)

- Introduction to electromechanics in mobile robotics (**T**);
- Electromechanical assembly of the mobile robotic platform (**L**).

Craft #4 (C4): Mobile Robotics Programming (12h T | 12h L | 12h H)

- Introduction to C language applied to *Arduino* programming (**T**);
- Describe the features of *Arduino* solutions and *ATMEL* microcontroller (*e.g.*, hardware architecture, cycles, pin configuration, communications), using the *Arduino* board (**T**);
- Identify the different wireless communication technologies used in robotics (*e.g.*, RF, Bluetooth, AdHoc, ZigBee) (**T**);
- Introduction to low-level algorithms, flowcharts and pseudocode (**T**);
- Acquire skills in the sensor and actuator practice used in robotics (**T** | **L**);
- Develop a typical differential kinematic application using *Arduino* (**L** | **H**).

Craft #5 (C5): Introduction to Linux (12h T)

- Introduction to Linux OS (**T**).

Craft #6 (C6): Robot Operating System (24h T | 12h L | 12h H)

- Introduction to *ROS* (**T**);
- Describe *ROS* features (*e.g.*, *stacks*, *publish-subscribe*, *topics*, *rosserial*), and provide specific examples and case studies (**T**);
- Present *ROS*-compatible simulators, such as *Morse*, *Stage* and *Gazebo* (**T**);
- Introduction to high-level algorithms, flowcharts and pseudocode (**T**);
- Follow *ROS* tutorial under *simulation* environment (**T** | **L**);
- Explore *rosserial* for *Arduino* – *ROS* communication (**T** | **L**);
- Develop a typical remote sensing application using both *Arduino* and *ROS* (**L** | **H**).

Craft #7 (C7): Artificial Intelligence (6h T | 6h L | 6h H)

- Introduction to Artificial Intelligence, presenting different paradigms and some real applications (**T**);
- Introduction and importance of integrating biologically-inspired models in robotics (**T**);
- Formalizing a mobile robotic approach, devising biologically-inspired algorithms and finite-state machines (**T** | **L**);
- Develop a streaming architecture to exchange all necessary data between *Arduino* and *ROS* (e.g., sensor readings, encoders readings, actuators control, etc.) (**L** | **H**);

Craft #8 (C8): Competition (6h T | 27h O)

- Discussion of the competitive events, rules and prizes (**T**);
- Consolidate concepts learned over all crafts and test the mobile robotic platform under a competitive scenario (**O**).

C. Bibliography

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