University *of Ljubljana*
Faculty *of Mechanical Engineering*

Digital Control Technology 5 ECTS

Lecturer: **D. Kozjek, P. Podržaj**

Lectures: 30h | Tutorials: 12h | Labs: 18h | Project: 0h | Lang. :

Objectives

The objectives of this course are:

- To learn the structure and operation of modern digital platforms (microcontrollers and FPGA circuits) and the possibilities of their use in mechatronics and control systems, to understand their capabilities and specifications.
- To learn the methods and procedures of hardware development for control applications based on powerful microcontrollers and FPGA circuits with particular emphasis on an interdisciplinary approach.
- To learn the methods and procedures for the development of controller software for micro-controllers, with particular emphasis on verification.

Programme

1. Digital integrated circuits
2. Development of Microcontroller Circuit Boards
3. Microcontroller architectures
4. Direct access to MCU peripherals
5. MCU interrupt system
6. Serial communications with MCUs
7. Standard MCU buses
8. Low power microcontroller applications
9. Operating systems for real-time processing
10. Developing a control application with FreeRTOS (by example)
11. Linux for Embedded Systems
12. Programmable logic: FPGA
13. Programming FPGAs for control applications

Prerequisites

In order to attend this course, the students are expected to:

- Have basic experience with programming in at least one programming language.

Learning outcomes

After attending this course, the student will obtain the following knowledge/skills:

- In-depth theoretical, methodological and analytical knowledge on applications of microcontrollers and FPGA circuits in mechatronics, which is the basis for very demanding professional work and enables the carrying out of leading tasks in interdisciplinary development teams in the field of mechatronics and laser technology.
- Mastering highly comprehensive, complex workflows and methodological tools in the field of mechatronics.
- Design and manage workflows based on creative problem solving related to mechatronics.

Assessment

50% Theoretical exam, 30% Independent classwork, 10% Laboratory work, 10% Project

Literature

1. Alvano J. Embedded Systems: Real-Time Operating Systems for Arm Cortex M Microcontrollers – 2nd edition. CreateSpace Independent Publishing Platform, 2012.
2. Johnson A. More to C - Advanced Programming with C in Linux and on Raspberry Pi – 1st edition. CreateSpace Independent Publishing Platform, 2017.
3. Monk S. Programming FPGAs: Getting Started with Verilog – 1st edition. McGraw-Hill Education TAB, 2016.