

# Course description

|                             |                              |                 |                  |
|-----------------------------|------------------------------|-----------------|------------------|
| <b>Course abbreviation:</b> | KEI/PMK                      | <b>Page:</b>    | 1 / 3            |
| <b>Course name:</b>         | Programming Microcontrollers |                 |                  |
| <b>Academic Year:</b>       | 2023/2024                    | <b>Printed:</b> | 30.05.2024 10:02 |

|                                         |                                                      |          |          |                               |                |
|-----------------------------------------|------------------------------------------------------|----------|----------|-------------------------------|----------------|
| <b>Department/Unit /</b>                | KEI / PMK                                            |          |          | <b>Academic Year</b>          | 2023/2024      |
| <b>Title</b>                            | Programming Microcontrollers                         |          |          | <b>Type of completion</b>     | Exam           |
| <b>Accredited/Credits</b>               | Yes, 4 Cred.                                         |          |          | <b>Type of completion</b>     | Combined       |
| <b>Number of hours</b>                  | Lecture 2 [Hours/Week] Tutorial 2 [Hours/Week]       |          |          | <b>Course credit prior to</b> | YES            |
| <b>Occ/max</b>                          | Status A                                             | Status B | Status C | <b>Counted into average</b>   | YES            |
| <b>Summer semester</b>                  | 17 / -                                               | 0 / -    | 0 / -    | <b>Min. (B+C) students</b>    | 10             |
| <b>Winter semester</b>                  | 23 / -                                               | 0 / -    | 0 / -    | <b>Repeated registration</b>  | NO             |
| <b>Timetable</b>                        | Yes                                                  |          |          | <b>Semester taught</b>        | Winter, Summer |
| <b>Language of instruction</b>          | Czech, English                                       |          |          | <b>Internship duration</b>    | 0              |
| <b>Optional course</b>                  | Yes                                                  |          |          | <b>Ev. sc. – cred.</b>        | S/N            |
| <b>Evaluation scale</b>                 | 1 2 3 4                                              |          |          |                               |                |
| <b>No. of hours of on-premise</b>       |                                                      |          |          |                               |                |
| <b>Auto acc. of credit</b>              | Yes in the case of a previous evaluation 4 nebo nic. |          |          |                               |                |
| <b>Periodicity</b>                      | K                                                    |          |          |                               |                |
| <b>Substituted course</b>               | None                                                 |          |          |                               |                |
| <b>Preclusive courses</b>               | N/A                                                  |          |          |                               |                |
| <b>Prerequisite courses</b>             | N/A                                                  |          |          |                               |                |
| <b>Informally recommended courses</b>   | N/A                                                  |          |          |                               |                |
| <b>Courses depending on this Course</b> | KEI/SNAEI, KEI/SNEI                                  |          |          |                               |                |

## Course objectives:

Students understand and can handle hardware of sophisticated microprocessors and microcontrollers. They can program miscellaneous tasks, also in real-time. Students are able to evaluate and compare different versions of computers. They will get basic knowledge of and experience with computer processing of signals.

## Requirements on student

Students have to prove their knowledge and abilities to solve practical tasks.

## Content

Content of lectures:

1. Introduction- pipelines, their properties and utilization in processors
2. RISC processors - structure and stages
3. RISC processors - function, conflicts in the pipeline, branch prediction
4. CACHE memory - integration in the computer, strategy of blocks swapping
5. ARM core - its blocks and function
6. CORTEX core - its blocks and function
7. Peripheral circuits of the 32-bit computers
8. Special architectures of computers - superscalar, multiprocessor, multithreading
9. Real-time operating systems - preemptive and cooperative, tasks and their sequencing
10. Internal communication in the computer - system controller, buses, external peripherals
11. Diagnostics of the computer - diagnostics of the data and program memory, processor, peripherals
12. Requirements on the computer in signals processing - algorithms complexity and their structure

Contents of labs:

Most part of the laboratory experiments and especially the individual projects are devoted to programming. The individual projects are assigned in the beginning of the semester. Four weeks are reserved for intensive consultations.

## Fields of study

## Guarantors and lecturers

- **Guarantors:** Doc. Dr. Ing. Vjačeslav Georgiev (100%)
- **Lecturer:** Doc. Dr. Ing. Vjačeslav Georgiev (50%), Ing. Kamil Kosturik, Ph.D. (25%), Prof. Ing. Jiří Pinker, CSc. (100%), Ing. Petr Weissar, Ph.D. (25%)
- **Tutorial lecturer:** Ing. Kamil Kosturik, Ph.D. (50%), Ing. Petr Weissar, Ph.D. (50%)

## Literature

- **Basic:** Baer, J. *Microprocessor Architecture*. ISBN 978-0-521-76992-1.
- **Basic:** Pinker, Jiří. *Mikroprocesory a mikropočítače*. Praha : BEN - technická literatura, 2004. ISBN 80-7300-110-1.
- **Recommended:** *Doplňková literatura z adresáře v síti (dle potřeby)*.
- **Recommended:** *Firemní literatura ARM, Renesas, STM, Atmel, NXP, Freescale*.
- **Recommended:** Yoseph Yiu. *The Definitive Guide to the ARM ? Cortex-M3*. 2010. ISBN 978-0-12-382090-7.

## Time requirements

## All forms of study

| Activities                                                 | Time requirements for activity [h] |
|------------------------------------------------------------|------------------------------------|
| Individual project (40)                                    | 20                                 |
| Preparation for an examination (30-60)                     | 30                                 |
| Contact hours                                              | 52                                 |
| Preparation for laboratory testing; outcome analysis (1-8) | 8                                  |
| <b>Total:</b>                                              | <b>110</b>                         |

## assessment methods

## Knowledge - knowledge achieved by taking this course are verified by the following means:

- Combined exam
- Skills demonstration during practicum
- Project

## Skills - skills achieved by taking this course are verified by the following means:

- Combined exam
- Skills demonstration during practicum
- Project

## Competences - competence achieved by taking this course are verified by the following means:

- Project

## teaching methods

## Knowledge - the following training methods are used to achieve the required knowledge:

- Lecture
- Laboratory work

Individual study

**Skills - the following training methods are used to achieve the required skills:**

Laboratory work

Individual study

**Competences - the following training methods are used to achieve the required competences:**

Individual study

**learning outcomes**

**Knowledge - knowledge resulting from the course:**

to describe function principles of modern computer systems and design the best solution for the task requirements

**Skills - skills resulting from the course:**

formulate the solution using an appropriate algorithm

to analyze requirement on a computer in concrete tasks

design, implement and debug programs running on modern computer systems

**Competences - competences resulting from the course:**

N/A

**Course is included in study programmes:**

| Study Programme                        | Type of             | Form of   | Branch                                   | Stage | St. plan v. | Year | Block               | Status | R.year | R. |
|----------------------------------------|---------------------|-----------|------------------------------------------|-------|-------------|------|---------------------|--------|--------|----|
| Applied Electrical Engineering         | Postgraduate Master | Combined  | Applied Electrical Engineering           | 1     | 20          | 2023 | Compulsory subjects | A      | 1      | LS |
| Electronics and Information Technology | Postgraduate Master | Full-time | Elektronics                              | 1     | 20          | 2023 | Compulsory courses  | A      | 1      | ZS |
| Electronics and Information Technology | Postgraduate Master | Full-time | Information and Communication Technology | 1     | 20          | 2023 | Compulsory courses  | A      | 1      | ZS |
| Electronics and Information Technology | Postgraduate Master | Full-time | Power Electronics Technology             | 1     | 20          | 2023 | Compulsory courses  | A      | 1      | ZS |
| Electronics and Information Technology | Postgraduate Master | Full-time | Elektronics                              | 1     | 20          | 2023 | Compulsory courses  | A      | 1      | ZS |
| Electronics and Information Technology | Postgraduate Master | Full-time | Information and Communication Technology | 1     | 20          | 2023 | Compulsory courses  | A      | 1      | ZS |
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