UNIVERSITY OF GOTHENBURG

# COMPUTER SCIENCE AND ENGINEERING

## DIT172 Parallel and Distributed Real-time System, 7.5 credits

Parallella och distribuerade realtidssystem, 7,5 högskolepoäng

*Second Cycle*

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### Confirmation

This course syllabus was confirmed by Department of Computer Science and Engineering on 2016-12-20 and was last revised on 2017-06-07 to be valid from 2017-08-20, autumn semester of 2017.

*Field of education:* Science 100%
*Department:* Computer Science and Engineering

### Position in the educational system

The course is part of the Computer Science Master's Programme. It is also given as single subject course at the University of Gothenburg.

The course can be part of the following programmes: 1) Computer Science, Master's Programme (N2COS), 2) Applied Data Science Master's Programme (N2ADS), 3) Game Design & Technology Master's Programme (N2GDT) and 4) Computer Science, Bachelor´s Programme (N1COS)

| *Main field of studies* | *Specialization* |
|---|---|
| Computer Science | A1F, Second cycle, has second-cycle course/s as entry requirements |

### Entry requirements

To be eligible for the course students should have successfully completed courses corresponding to 120 higher education credits within the subject Computer Science or equivalent, including DIT161 Real-Time systems, 7.5 hec, or equivalent is required.

Applicants must prove knowledge of English: English 6/English B or the equivalent level of an internationally recognized test, for example TOEFL, IELTS.

**Learning outcomes**

On successful completion of the course the student will be able to:

*Knowledge and understanding*

- demonstrate knowledge about the terminology of scheduling and Complexity theory.
- describe the principles and mechanisms used for scheduling of task execution and data communication in real-time systems

*Competence and skills*

- formulate requirements for computer systems for time and safety critical applications.
- design realtime systems and apply techniques to verify whether the realtime requirements are met or not.
- derive the theoretical performance limitations of a given real-time system.

*Judgement and approach*

- determine the best design for a target implementation by deriving performance of design alternatives of real-time systems

**Course content**

This course is intended to give a deeper understanding of the problems involved in designing real-time systems based on multiprocessor architectures.

Specifically, the course covers the following topics:
• Background: motivation for; and definition of; real-time computing systems.
• Characteristics of real-time systems: application constraints; Design methods; task models; run-time mechanisms; architectures.
• Evaluation of real-time systems: performance measures; Evaluation methodologies.
• Single and multiprocessor scheduling: problem definition; terminology; and algorithms.
• Complexity theory and NP-completeness in the context of real-time scheduling.
• real-time communications: protocols and end-to-end delay guarantees.
• Fault-tolerance techniques for real-time systems: models; algorithms and architectures.
• Estimation of task execution times.

*Sub-courses*

1. **Homework assignment 1** *(Hemuppgift 1),* 4 higher education credits
   Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)
2. **Homework assignment 2** *(Hemuppgift 2),* 3.5 higher education credits
   Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)

**Form of teaching**

The course is organized as a series of lectures. There are two homework assignments on the specific topics covered during the lectures. A weekly consultation session offers assistance regarding questions and problems related to the homework assignments.

*Language of instruction:* English

**Assessment**

The course is examined by 2 homework assignments, one in the middle of the course and the other at the end of the course. For each of the homework assignments the student shall submit a written report that gets orally examined. The written reports are carried out normally in pairs and the oral exams are individually performed.

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

In cases where a course has been discontinued or has undergone major changes, the student shall normally be guaranteed at least three examination occasions (including the ordinary examination) during a period of at least one year from the last time the course was given.

**Grades**

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).
In order to be awarded the grade Pass (G) for the whole course, the students' needs to get the grade G on both sub courses . In order to be awarded the grade Pass with Distinction (VG) for the full course, the student needs to get the grade VG on both sub courses.

**Course evaluation**

The course is evaluated through meetings both during and after the course between teachers and student representatives. Further, an anonymous questionnaire is used to ensure written information. The outcome of the evaluations serves to improve the course by indicating which parts could be added, improved, changed or removed.

**Additional information**

The course is a joint course together with Chalmers.

Course literature to be announced the latest 8 weeks prior to the start of the course.

The course replaces the DIT171 Parallel and Distributed Real-time Systems, 7.5 hec, course. The course cannot be included in a degree which contains DIT171. Neither can the course be included in a degree which is based on another degree in which the course DIT171 is included.