HALMSTAD UNIVERSITY
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School of Information Technology

Real-Time Embedded Systems 7.5 credits

Inbyggda realtidssystem 7.5 hp

Second cycle
Main field: Computer Science and Engineering, Second cycle, has only first-cycle course/s as entry requirements (A1N)
Syllabus is adopted by the Research and Education Board (2024-03-20) and is valid for students admitted for the autumn semester 2024.

Placement in the Academic System

Master's Programme in Embedded and Intelligent Systems, 120 credits and Computer Science and Engineering, 300 credits.
The course is also offered as a freestanding course.

Prerequisites and Conditions of Admission

Bachelor of Science degree (or equivalent) in an engineering subject or in computer science. Courses in computer science, computer engineering or electrical engineering of at least 90 credits, including thesis. Courses in mathematics of at least 30 credits or courses including calculus, linear algebra and transform methods. Algorithms and Data Structures 7.5 credits. The degree must be equivalent to a Swedish kandidatexamen or Swedish högskoleingenjörsexamen and must have been awarded from an internationally recognised university. English 6. Exemption of the requirement in Swedish is granted.

Course Objectives

The course introduces design, analysis and programming techniques suitable for real-time and embedded systems. The course mainly addresses theory and techniques for concurrency, real time and reactivity. The course also addresses programming language support for concurrency, real time and reactivity. The course is based on prior knowledge and experience in sequential programming (e.g., C and Java).

Following successful completion of the course the student should be able to:

Knowledge and understanding

- explain different models of computation, concurrency, and communication among processes
- explain characteristics of real time systems, their analysis, and constructions to deal with them in programs

Skills and ability

- program and use a kernel to support concurrency
- design, structure and analyze algorithms, task sets, and programs for embedded systems

Judgement and approach

- compare, select and apply different programming techniques and implementation designed for concurrency and real time.

Primary Contents

- Models of computation for embedded systems
- Programming models for reactive systems: concurrency, synchronization, and mututal exclusion. Low level implementation of real-time, reactive, and concurrent constructs.
- Analysis and design of real time systems: scheduling and schedulabilityanalysis, programming construct for real-time systems.

Teaching Formats

Concepts, methods, problems and solutions are presented in a series of lectures. Lectures are complemented with supervised short computer based exercises. A number of laborations with several supervision occasions allow the students to formulate their own designs and implementations.

Teaching is in English.

Examination

The overall grades of Fail, 3, 4 or 5 will be awarded for the course.
The course is evaluated in 3 parts: a written examination, a practical part (laborations) and the scientific seminar.
The practical part is examined by means of laborations for which written or spoken reports should be passed. To pass the practical part of the course all laborations should be passed. Finnaly, towards the end of the course a presentation session is held, where students present a scientific paper they have read and written a short report about.

Name of the test		Grading
Written Examination	3 credits	U/3/4/5
Laboratory Work	1,5 credits	U/G
Seminar	3 credits	U/G

If there are special reasons, the examiner may make exceptions from the specified examination format and allow a student to be examined in another way. Special reasons can e.g. be a decision on learning support.

For elite sports students according to Riktlinjer för kombinationen studier och elitidrott vid Högskolan i Halmstad, DNR: L 2018/177, the examiner has the right to decide on an adapted examination component or let the student complete the examination in an alternative way.

Course Evaluation

Course evaluation is part of the course. This evaluation should offer guidance in the future development and planning of the course. Course evaluations should be documented and made available to the students.

Course Literature and Other Study Resources

E. A. Lee and S. A. Seshia. *Introduction to Embedded Systems: A Cyber-Physical Systems Approach,* 2nd Ed., LeeSeshia. org, 2015. The book is available on-line `http://leeseshia.org/`.