UNIVERSITY OF GOTHENBURG

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DIT616 Data-driven support for cyber-physical systems, 7.5 credits

Data-drivet stöd för cyberfysiska system, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Computer Science and Engineering on 2021-11-15 to be valid from 2022-08-29, autumn semester of 2022.

Field of education: Science 30% and Technology 70%
Department: Department of Computer Science and Engineering

Position in the educational system

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

The course can be part of the following programme: 1) Computer Science, Master's Programme (N2COS)

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

Entry requirements

Bachelor's degree in Computer Science, or equivalent is required.

The student should have successfully completed the following courses (or equivalent):

- DIT791 Introduction to ComputerEngineering, 7.5 hec,
- DIT602 Algorithms, 7.5 hec,
- DIT960 Data Structures, 7.5 hec, and
- at least 7.5 hec in programming.

Furthermore, the student should have completed 7.5 hec or equivalent in one of the four areas:

- Computer Communication (such as DIT423 or equivalent), or
- Operating Systems (such as DIT401 or equivalent), or
- Computer Security (such as DIT641 or equivalent), or
- Distributed Systems (such as DIT240 or equivalent).

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

- List cyber-physical systems, and in particular information and communication technologies (ICT) methods for supporting adaptiveness and cybersecurity based on the student's chosen area, for example, design of protocols or algorithms, security issues, data management and evaluation methodology,
- Discuss current research and development in the area of such cyber-physical systems, in order to meet the requirements of sustainable development in terms of security, economy and ecology,

Competence and skills

- Design and analyse methods, algorithms, protocols for adaptive and cybersecure cyber-physical systems, such as smart power grid networks,
- Work with advanced algorithms such as parallel or distributed algorithms for efficient data processing and adaptations or algorithmic implemetations of them so that they can meet needs of the system in focus,
- Plan and organize a small team project and document the work and the result in a report,

Judgement and approach

- Present complex material to a small audience,
- Work in a small-team project, on planning, scheduling and conducting the work,
- Judge the relevance of the literature in a topic.

Course content

The course gives an introduction to new cyber-physical systems, such as the smart grid, where data has become very important for adaptive operations and with an increased dependence on information and communication technologies (ICT). Topics in the course are focused on new methods in the intersection of computer science and other domains, to support distributed operations, cyber security, and processing of data that

are generated due to digitalization of these systems (considering that the data can be massive).

The content is focused on distributed computing and systems, data processing, information and systems security, networking and computer communication in the context of new cyber-physical systems. There are lectures from the faculty to give an overview of the areas of the course, and invited presentations from industry to talk about actual systems, as well as in-depth presentations by the student themselves on specific research topics relating to their projects.

Typically, the lectures include an introduction to the new types of cyber-physical systems, e.g., the smart grid. Open research problems in relation to distributed operations, data-processing and cyber security are discussed, e.g., through lectures on streaming, security and privacy, and communication suitable in this domain. Examples of cyber-physical systems important for society are presented, e.g., the smart grid from both on the transmission and distribution perspective. The course starts with an introduction to power systems, to give students enough knowledge of terminology to understand papers connected to the smart grid.

Sub-courses

1. **Project** *(Projekt),* 7.5 credits
   Grading scale: Pass with distinction (5), Pass with credit (4), Pass (3) and Fail (U)

Form of teaching

Lectures, seminars, projects.

This project course setup includes a short sequence of introductory lectures given by lecturers and invited talks from the industry, that will prepare the students and allow their project groups to share a wider common background. The students will then choose advanced topics related to their chosen projects, to study a set of problems in depth. These topics are presented by the students to their peers and discussed in the classroom. In addition, the students will write an individual report about their chosen topic and a project report with their group.

Language of instruction: English

Assessment

The course is examined through a written report on the project conducted by the students, and oral presentation, including demonstration. The written report is normally carried out in small groups of students. The students also need to complete a small set of individual reports, reflecting on the project and the group dynamics as well as giving feedback on the work of other groups. There is also a short proposal for future projects

(creation of new ideas). In order to pass the course the student is expected to also participate actively in seminars, including presentations and discussion of new topics. If a student misses a mandatory seminar, he or she is then expected to complete an extra assignment.

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 (5), Pass with credit (4), Pass (3) and Fail (U).
To be awarded grade 3, the student shall demonstrate multi structural knowledge by carrying out presentations and producing a report that is well structured and easy to read, that analyses a related problem using concepts defined by the course literature, that properly cites the course literature, and whose content covers all learning outcomes.

To be awarded grade 4, the student shall demonstrate relational knowledge by carrying out presentations and producing a report that, that additionally analyses a related problem synthesizing sources whose association was made by the student explicitly to arrive at conclusions that cannot be made from a single perspective alone.

To be awarded grade 5, the student shall demonstrate advanced relational knowledge by carrying out presentations and producing a report that, in addition, incorporates relevant theories not covered by the course literature in the analysis and that synthesizes findings from several theoretical perspectives to arrive at conclusions that are based on a multitude of perspectives.

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, while the detailed list to support the student projects will be decided during the first course week.

The course replaces the course DIT615, 7.5 credits. The course cannot be included in a degree which contains DIT615. Neither can the course be included in a degree which is based on another degree in which the course DIT615 is included.