Reg No: DVGA28/20261

Faculty of Health, Science and Technology
Computer Science

Syllabus

Computer systems I

Course Code:	DVGA28
Course Title:	Computer systems I *Datorsystem I*
Credits:	15
Degree Level:	Undergraduate level
Progressive Specialisation:	First cycle, has less than 60 credits in first-cycle course/s as entry requirements (G1F)

Major Field of Study:
DVA (Computer Science)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2025-08-26, and is valid from the Spring semester 2026 at Karlstad University.

Prerequisites
Registered for Programming and Data Structures, 15 ECTS credits, and Mathematics for Artificial Intelligence I, 15 ECTS credits, or equivalent.

Learning Outcomes
Upon completion of the course, students should be able to:

Module 1 Digital Electronics (3 ECTS cr)
1. convert numbers between different number systems, and
2. analyse and design combinational and sequential circuits.

Module 2 Computer Engineering (6 ECTS cr)
3. describe and explain the structure and function of the components of a computer, and how they interact,

4. give an account of data representation and arithmetic in computer systems,
5. solve programming tasks in an assembly language, applying conventions for resource usage (registers and stack memory),
6. analyse the time efficiency of program sequences with respect to memory system architecture, and
7. write high-level language programs for graphics processing units (GPUs).

Module 3 Theoretical Computer Science (6 ECTS cr)
8. describe and evaluate formal languages using the pumping lemma, automata, expressions, and grammars,
9. construct Turing machines to solve problems, and
10. analyse the time complexity of algorithms.

Content
Module 1 Digital Electronics (3 ECTS cr)
Digital technology focuses on the analysis and design of digital circuits. This module covers fundamental topics such as number systems, Boolean algebra, logic gates, and combinational circuits (including normal forms and Karnaugh maps), as well as flip-flops and sequential circuits.

Module 2 Computer Engineering (6 ECTS cr)
This module explores the structure and functionality of computer systems, as well as the interface between software and hardware. Topics include data representation and arithmetic, assembly programming, memory systems (including cache memory), the architecture and operation of modern processors, and interrupt handling. Parallel processors, such as GPUs, are also covered.

Module 3 Theoretical Computer Science (6 ECTS cr)
This module covers the foundations of automata theory, formal languages, computability, and complexity theory. It is essential for understanding the capabilities and limitations of computers, including why some problems are computationally unsolvable while others are easy or hard to solve. In automata theory and formal languages, the module explores regular languages (with expressions and finite automata), context-free languages (with grammars and pushdown automata), and the pumping lemma. In computability theory, topics include Turing machines, the Church-Turing thesis, and the decidability of languages (problems). The final part of the module focuses on complexity theory, addressing complexity classes and the time complexity of algorithms. The use of AI to tackle hard problems (NP problems) is also discussed.

Reading List
See separate document.

Examination
Module 1 is assessed based on an individual written hand-in assignment and an oral presentation.
Module 2 is assessed based on a written exam and individual lab work with oral and written reports.
Module 3 is assessed based on a written exam and an individual written hand-in assignment.

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

Grades

One of the grades Distinction (VG), Pass (G), or Fail (U) is awarded in the examination of the course. For students in Engineering, one of the grades 5 (Pass with Distinction), 4 (Pass with Some Distinction), 3 (Pass), or U (Fail) is awarded in the examination of the course.

Quality Assurance
Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate
A course certificate will be provided upon request.

Additional information
The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.