

**SYLLABUS**

# **Game engine architecture**

## **15 credits S0011E**

**Datorspelsmotorers arkitektur**

**Course syllabus admitted: Autumn 2024 Sp 1 - Present**

**DECISION DATE**  
**2024-02-15**

# Game engine architecture 15 credits S0011E

## Datorspelsmotorers arkitektur

### First cycle, S0011E

**Education level**  
First cycle

**Grade scale**  
G U 3 4 5

**Subject**  
Medieteknik

**Subject group (SCB)**  
Computer Technology

## Entry requirements

In order to meet the general entry requirements for first cycle studies you must have successfully completed upper secondary education and documented skills in English language and 15 hp Mathematics, e.g. M0050 - Basic Mathematics and Derivatives, M0051M - Integrals, Vectors and Matrices or equivalent.

30 hp Programming with focus on graphics programming, e.g. D0037D Object-oriented programming, D0041D Data structures and algorithms, S0009E Computer graphics programming or equivalent.

Good knowledge in English equivalent to English 6.

## Selection

The selection is based on 1-165 credits.

## Course Aim

The course aims to provide the skills necessary to architect and develop modern game engines and how these can be modified to expand and/or modify its functionality.

After course completion, the student should be able to demonstrate:

- broad knowledge in the field of computer game development at the system level
- ability to understand and apply knowledge of mathematics and science for specific topics in game engines
- ability to model, simulate, predict and evaluate methods and algorithms for the components used in a computer game and their implementation in a game engine
- ability to identify the need for further knowledge and to continuously upgrade the skills by analyzing an existing game engine and adding new functionality
- ability to demonstrate an understanding of game engine architecture and development environments.
- ability to apply knowledge of various common subsystems to build games from scratch.
- ability to architect and design game engines that fulfills the needs and requirement of a game development team, including, but not limited to, graphics artists and level designers.
- ability to apply knowledge of network programming to develop scalable solutions for game development teams.
- ability to understand, implement and elaborate artificial intelligence algorithms in computer games.
- ability to understand and implement artificial intelligence at the system level in a game engine.
- insight into the role of artificial intelligence in computer games and insight into the development process.

## Contents

The course covers game engine architecture, components, function requirements and their purpose and relationships, game engines and development environments for different platforms and gaming applications, APIs, analysis of performance and functionality, production pipeline and its impact on design and development methodology.

The course also covers how to apply data oriented design to improve performance, maintainability and simplicity, together with the ability to more easily parallelize different parts of a game engine. To reach the intended learning goals for developing networked solutions for game development teams, this course also covers basic network programming. To make computer games come to life, intelligent opponents must be added to the game. In this course topics like autonomous agents, pathfinding and flocking will be studied. Higher level topics studied are decision making, strategy, learning and architectures for AI implementation. Computer games are analysed to get familiar with how and what AI do in different games.

## Realization

Each course occasion's language and form is stated and appear on the course page on Luleå University of Technology's website.

The course includes lectures, assignments, seminars.

The student will practice critical thinking and discussions of time critical programming and data oriented approaches.

## Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided. Compulsory assignments and seminars. Oral presentations and written essays.

Each assignment is specified with requirements for each grade. The final grade is weighted average of the assignment grade.

## Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term "unauthorized aids" refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

## Course offered by

Department of Computer Science, Electrical and Space Engineering

## Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0003	Laboratory work 1	G U 3 4 5	2	Mandatory	A24	
0004	Laboratory work 2	G U 3 4 5	2	Mandatory	A24	
0005	Laboratory work 3	G U 3 4 5	2	Mandatory	A24	
0006	Laboratory work 4	G U 3 4 5	2	Mandatory	A24	
0007	Laboratory work 5	G U 3 4 5	3	Mandatory	A24	
0008	Oral and written presentation	U G#	4	Mandatory	A24	

## Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

## Last revised

by Robert Brännström 2024-02-15

## Syllabus established

by Jonny Johansson, HUL SRT 2021-02-16