Complex IT Systems – Theory

Title	Complex IT Systems – Theory
Semester	E2023
Master programme in	Computer Science
Type of activity	Course
Teaching language	English
Study regulation	Read about the Master Programme and find the Study Regulations at ruc.dk

REGISTRATION AND STUDY ADMINISTRATIVE

Registration	You register for activities through stads selvbetjening during the announced registration period, which you can see on the Study administration homepage. When registering for courses, please be aware of the potential conflicts and overlaps between course and exam time and dates. The planning of course activities at Roskilde University is based on the recommended study programmes, which should not overlap. However, if you choose optional courses and/or study plans that goes beyond the recommended study programmes, an overlap of lectures or exam dates may occur depending on which courses you choose.
Number of participants	
ECTS	15
Responsible for the activity	Troels Andreasen (troels@ruc.dk)
Head of study	Henrik Bulskov (bulskov@ruc.dk)
Teachers	
Study administration	IMT Registration & Exams (imt-exams@ruc.dk)
Exam code(s)	U60056

ACADEMIC CONTENT

Overall objective	Software engineering methods and principles, machine architecture and operating systems, distributed systems, databases and human to machine interactions. The course includes a presentation and critical discussion as well as testing of knowledge and understanding of the core areas in each of these subjects.

Detailed description of content

This course will cover selected topics from theory on databases, networks and user interfaces and will in addition involve hands-on practical experience with special emphasis on development of responsive applications in a distributed environment.

Focus will be on client-server environments, a responsive application draws on functionality made available through web services, which in turn draws on data from one or more databases and possibly other sources.

The course is divided in four sections. The content of each of these is outlined below.

Section 1: Data and Databases

In this section we will cover a number of key topics from database theory. First of all we will cover the relational model and the relational algebra as well as the relational language database SQL. We will go into two important approaches to database design, namely database modelling using the Entity-Relationship model and analysis using normalisation theory. We will briefly discuss database indexing and query optimization as well as transaction management. As far as programming is concerned we will consider two different approaches. One approach concerns implementation of functions, procedures and triggers to be stored directly in the database. The other approach concerns integration of database access into application programs and services – either using database interfaces or the so-called Object Relational Mapping (ORM).

Section 2: Data communication and network with focus on web services

This section will include a general introduction to network architecture and distributed systems. There will be a special focus on web services, including context, technology, communications, languages, protocols and architecture related to these. The main development language for server programming will be the object-oriented language c# (similar to java). For the connection to the database we will look at an ORM framework and linq, which is an extension of c# specifically directed at simplifying the processing of relational data in an object-oriented context, and for the web services we will use asp.net web api, which is a framework specific for supporting restful web services interfaces.

Section 3: Development of single-page web applications

We touch on the general theory and practice related to designing and implementing graphical user interfaces. We will implement front-end applications that run on the users browser. They will be implemented in JavaScript, HTML, and CSS and will use a front-end UI library for developing so-called single-page applications (SPA) which communicate asynchronously with the backend and thus hide these communications from the user. We will cover modular and composable UI components, routing and navigation, application state management, and advanced JavaScript, including asynchronous programming and event-driven programming.

Section 4: Security

Attacks on web-sites and methods to protect against the attacks. Attacks covered include SQL injection attacks on databases, attacks on password-based user-authentication, and cross-site scripting attacks that display web-content from a malign third party.

Course material and Reading list	Main key references in Database Systems, C# and JavaScript, as well as additional course literature, can be found on the Moodle page for the course.
Overall plan and expected work effort	The course will have a total workload of 412 hours with 135 hours of lectures and exercises, 232 hours of preparation over a 15-week course period and 45 hours for the exam and preparation before the course. The activity's major teaching and learning activities are fleshed out ● In class teaching ● Exercises ● Mandatory assignments on course topics ● Homework individually/in study groups and these may be further developed with description of the processes involved, links to files with descriptions, etc.
Format	
Evaluation and feedback	Evaluation form to be filled out (anonymously) plus open discussion on the last course day.
Programme	

ASSESSMENT

Overall learning outcomes	After completing this activity, students will be able to: ● demonstrate knowledge and understanding of key theories in the core subject areas and techniques for the design and construction of software systems meeting specific requirements. ● show comprehensive overview of and understanding of the general principles behind the hardware and software systems that are part of modern computers and the users' interactions with these. ● selecting and applying appropriate methods and techniques from the subject area for the analysis, design, and construction of software systems. ● demonstrate competences in being able to work with IT issues, both independently and in teams, and in being able to critically and systematically learn new approaches to the subject area and thereby independently take responsibility for one's own professional development.
Form of examination	Individual oral exam without time for preparation. Time allowed for exam including time used for assessment: 30 minutes. Permitted support and preparation materials: All. Assessment: 7-point grading scale. Moderation: External examiner.
Form of Re-examination	Samme som ordinær eksamen / same form as ordinary exam
Type of examination in special cases	

Examination and assessment criteria	It will be assessed to which degree the student demonstrates knowledge and understanding of key theories in the core subject areas of the three sections (outlined above). Before the exam students will know the exam questions for each of the three sections. At the exam the student will pick a set of three questions, one from each section.
Exam code(s)	Exam code(s) : U60056

Course days:

Hold: 1

Study- and semesterstart - 1st semester - Computer Science (COMP)

time	04-09-2023 10:00 til 04-09-2023 16:00
location	10.2-049 - teorirum (58)

Complex IT Systems - Theory (COMP)

time	05-09-2023 09:00 til 05-09-2023 17:00
location	03.1-s03 - auditorie a (120)
Teacher	Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time	07-09-2023 13:00 til 07-09-2023 17:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	08.1-032 - teorilokale (96)
Teacher	Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 13-09-2023 08:15 til
13-09-2023 16:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 15-09-2023 08:15 til
15-09-2023 12:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 20-09-2023 08:15 til
20-09-2023 16:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 22-09-2023 08:15 til
22-09-2023 12:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 25-09-2023 08:15 til
25-09-2023 12:00

location 09.2-009 - teorilokale (60)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 27-09-2023 08:15 til
27-09-2023 16:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 29-09-2023 08:15 til
29-09-2023 12:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 04-10-2023 08:15 til
04-10-2023 16:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 06-10-2023 08:15 til
06-10-2023 12:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 11-10-2023 08:15 til
11-10-2023 16:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 13-10-2023 08:15 til
13-10-2023 12:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 18-10-2023 08:15 til
18-10-2023 16:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 20-10-2023 08:15 til
20-10-2023 12:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 25-10-2023 08:15 til
25-10-2023 16:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 27-10-2023 08:15 til
27-10-2023 12:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 01-11-2023 08:15 til
01-11-2023 16:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 03-11-2023 08:15 til
03-11-2023 12:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 08-11-2023 08:15 til
08-11-2023 16:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 10-11-2023 08:15 til
10-11-2023 12:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 13-11-2023 08:15 til
13-11-2023 16:00

location 05.1-032 - teorirum 05.1 (65)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 15-11-2023 08:15 til
15-11-2023 12:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 17-11-2023 08:15 til
17-11-2023 12:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 22-11-2023 08:15 til
22-11-2023 16:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 24-11-2023 08:15 til
24-11-2023 12:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time 29-11-2023 08:15 til
29-11-2023 16:00

location 10.2-049 - teorirum (58)

Teacher Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time	01-12-2023 08:15 til 01-12-2023 12:00
location	10.2-049 - teorirum (58)
Teacher	Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time	06-12-2023 08:15 til 06-12-2023 16:00
location	10.2-049 - teorirum (58)
Teacher	Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time	08-12-2023 08:15 til 08-12-2023 12:00
location	10.2-049 - teorirum (58)
Teacher	Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time	13-12-2023 08:15 til 13-12-2023 16:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	42.2-37 - teorirum (foldedør ud til kantineområdet) (50)
Teacher	Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory (COMP)

time	15-12-2023 08:15 til 15-12-2023 12:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt
location	42.2-37 - teorirum (foldedør ud til kantineområdet) (50)

Teacher	Troels Andreasen (troels@ruc.dk)

Complex IT Systems - Theory - Oral examination (COMP)

time	23-01-2024 08:15 til 25-01-2024 18:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt

Complex IT Systems - Theory - Oral reexamination (COMP)

time	23-02-2024 08:15 til 23-02-2024 18:00
forberedelsesnorm	ikke valgt
forberedelsesnorm D-VIP	ikke valgt