ICAT3130 Mobile Application Development, 5 cp

<table>
<thead>
<tr>
<th>Prerequisites</th>
<th>It is highly recommended to know: The general knowledge of Programming Languages.</th>
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<td>Objectives</td>
<td>The mobile devices become the major tool to access the digital world with huge different applications including for example, e-commerce, e-health, e-government, social networks, as well as many industrial applications. The increased penetration of cloud computing has increased also the capability of mobile devices. Hence, no need to perform intensive computing on mobile devices. The needs for mobile application developers have been dramatically increasing in job markets. The students who pass this course successfully will be able to implement applications on mobile platforms. Although the main development tools in this course will be Java and Android, however, the students will learn the concepts of application development over cross-platform. Course develops lifelong learning, Oral, written and interpersonal skills (Group Work, English), critical and analytical thinking, problem modelling and solving skills, IT skills and optimized decisions.</td>
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<td>Content</td>
<td>In the lectures the theoretical parts required for the exercises and the project work are presented. To the course contents belong the Design and Implementation Principles of Mobile Applications. In addition, the development rules for mobile applications are discussed. Furthermore, the use of libraries, managing resources as well as concurrency will be taught. The device to device communication belongs also to the content of the course.</td>
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</table>
| Study Materials | 1. Lecturer Notes  
2. Additional Material can be found on the course website ([target=_blank>http://teg.uwasa.fi/courses/ICATxxxx](http://teg.uwasa.fi/courses/ICATxxxx)) |
| Teaching Methods | lectures 24 h + Exercises 24 h+ independent work 84 h |
| Modes of Study | Exercises + Projects |

ICAT3050 Embedded System Architecture and Design, 5 cp

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<th>Prerequisites</th>
<th>It is highly recommended to know: Basics of Electronics and Basics of Programming</th>
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<td>Objectives</td>
<td>After completing this course the student will be able to understand the Design Principles of Modern Processors and Bus Systems. In addition, the student will also learn how to implement programs with assembly programming language in order to understand the internal components of the Central Processing Unit. The skills learned in the lectures must be applied in the exercises. Furthermore, the students will learn about the Design Challenges (Optimizing Design Metrics) as well as the Design of an Embedded System. The students need to do a case study, where they need to Design an Embedded System based on certain requirements. Course develops lifelong learning, Oral, written and interpersonal skills (Group Work, English), critical and analytical thinking, problem modeling and solving skills, IT skills and optimized decisions.</td>
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<td>Content</td>
<td>Numbering and Coding Systems, Buses, Sequential Logic Design (Minimized Output Equations), Memory Decoder, Memory Organization, Memory Types, Cache, Interrupts, Instruction Pipelines, Reduced Instruction Set Computer (RISC)</td>
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| Study Materials | 1. Lecturer Notes  
3. For further books (see course website: [http://teg.uwasa.fi/courses/ICATxxxx](http://teg.uwasa.fi/courses/ICATxxxx)) |
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<td>Teaching Methods</td>
<td>lectures 24 h + Exercises 24 h + independent work 84 h</td>
</tr>
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<td>Modes of Study</td>
<td>Exam + Project Work</td>
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**ICAT1010 C Programming, 3 cp**

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<tr>
<th>Prerequisites</th>
<th>TITE1070 Programming or ICATC1050 Introduction to Programming or respective course which covers the principles of programming, this course is targeted to students without prior knowledge of C.</th>
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<td>Objectives</td>
<td>this course aims to teach the skills necessary for the development of C applications. After completing this course the student will be able to develop C programs containing simple data structures. The student will learn how to implement programs according to given or own developed flowcharts. Also the use of debuggers will be introduced and applied. The skills learned in the lectures must be applied in the exercises. Course develops lifelong learning, oral; written and interpersonal skills (Group Work, english), critical and analytical thinking, problem modeling and solving skills, IT skills and optimized decisions.</td>
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<tr>
<td>Content</td>
<td>In the lectures the theoretical parts required for the exercises are presented. To the course contents belong data types, conditions, loops, arrays and pointers, macros, static and dynamic allocation, structures, time handling and file handling. The exercises contain the development of C/C++ applications related to the previously mentioned course contents.</td>
</tr>
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</table>
| Study Materials | lecture slides and course book  
| Teaching Methods | lectures 16 h and exercises 16 h, independent work 46 h |
| Modes of Study | lectures, practical exercises, and final examination  
**Languages:** English (lectures and exercises) |

**ICATC2070 Software Engineering Project, 5 cp / 3 cu**

| Key Words | **Structure Type:** Course  
**Type:** Optional Vamk and VY TkK-information technology |
### Prerequisites
Olio-ohjelmointi, Ohjelmistotuotannon käytännöt.

### Objectives
During the industry-based software project the student learns to apply the knowledge and skills he or she has adopted during the preceding courses. The student understands the importance of changing customer requirements and learns to work in a project team. In the project team the student learns to apply a suitable life cycle model for their software project. The student also learns the importance of continuous learning in work place as in projects they will confront new techniques and interfaces. Course develops interpersonal skills, problem solving and decision-making skills, product development and marketing, organizational operation.

### Content
Basic skills: Documentation of a software project and acting as a project team member. Management of meeting practices of a software project and use of project management tools. Implementation of a software project through teamwork. Adoption of new technologies that are needed in implementing a software project. Implementation of software project in the energy sector. Review and inspection practices.

### Study Materials
Teacher will announce during the course

### Teaching Methods
Problem based learning in a client project

### Modes of Study
**Assessment Criteria:** Assessment via three iterations, which are made for the implementation, the documentation and the presentation of the project.
- **Grade 5:** Student understands most of the discussed topics, has the ability to apply the topics independently or to develop an application with a number of advanced features.
- **Grade 3:** Student understands the discussed topics, has the ability to apply the topics or develop an application with a reasonable amount of features.
- **Grade 1:** Student understands the basics of discussed topics, has the ability to apply the topics or develop a simple application.

**Assessment Methods:** Continuous assessment, the grade is based on homework, project tasks and examination.

### ICAT3120 Machine Learning, 5 cp

### Prerequisites
It is highly recommended to know: fundamentals of probability theory, and university level calculus.

### Objectives
With the integration of smart devices and systems in human life, it comes the need for intelligent decisions based on the huge data streaming through sensors (e.g., IoT) as well as other sources of technical and nontechnical information. Intelligence includes the capability to learn from data. The intention is to find hidden structure and recognize regular patterns that represent certain relations. Machine learning topic includes (massive) data classification, clustering and projection. The learning is an accumulated process, in the sense that more data carry more information and hence more sharp knowledge about the process. Learning algorithms lead to accurate prediction about the future and also provide rules for the decision makers in autonomous systems.

The aim of this course is to introduce the foundations of machine learning algorithms with more concentration on the practical applications. The students who successfully pass this course will be able to understand the concepts of machine learning and also several standard learning algorithms. Furthermore, they will be able to write simulation codes to solve some real problems with machine learning. The applications of machine learning in this course may cover...
vast areas such as: pattern recognition, data mining, robotics, smart automation, cyber-security, bioinformatics and e-health etc. Course develops lifelong learning, Oral, written and interpersonal skills (Group Work, English), critical and analytical thinking, problem modeling and solving skills, IT skills and optimized decisions.

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<th>Content</th>
<th>Data modelling with different statistical regression approaches, parameter modeling and estimation techniques, Bayesian decision theory approach, data classification and clustering algorithms, Principal component analysis approach, Decision trees, Hidden Markov Models approach, Reinforcement learning, and Applications.</th>
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| Study Materials | 1. Lecturer Notes  
| Teaching Methods | lectures 32 h, independent work 103 h |

**ICAT3050 Embedded System Architecture and Design, 5 cp**

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<td>Numbering and Coding Systems, Buses, Sequential Logic Design (Minimized Output Equations), Memory Decoder, Memory Organization, Memory Types, Cache, Interrupts, Instruction Pipelines, Reduced Instruction Set Computer (RISC) Architecture, Timer, Assembly Language Programming, Computation Models, State Machine Models, Design Challenges (Optimizing Design Metrics), Custom Single-Purpose Processor Design, Requirements for Embedded Systems Design etc.</td>
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| Teaching Methods | lectures 24 h + Exercises 24 h + independent work 84 h |
| Modes of Study | Exam + Project Work |
### ICAT3130 Mobile Application Development, 5 cp

**Prerequisites**
It is highly recommended to know: The general knowledge of Programming Languages.

**Objectives**
The mobile devices become the major tool to access the digital world with huge different applications including for example, e-commerce, e-health, e-government, social networks, as well as many industrial applications. The increased penetration of cloud computing has increased also the capability of mobile devices. Hence, no need to perform intensive computing on mobile devices. The needs for mobile application developers have been dramatically increasing in job markets. The students who pass this course successfully will be able to implement applications on mobile platforms. Although the main development tools in this course will be Java and Android, however, the students will learn the concepts of application development over cross-platform. Course develops lifelong learning, Oral, written and interpersonal skills (Group Work, English), critical and analytical thinking, problem modelling and solving skills, IT skills and optimized decisions.

**Content**
In the lectures the theoretical parts required for the exercises and the project work are presented. To the course contents belong the Design and Implementation Principles of Mobile Applications. In addition, the development rules for mobile applications are discussed. Furthermore, the use of libraries, managing resources as well as concurrency will be taught. The device to device communication belongs also to the content of the course.

**Study Materials**
1. Lecturer Notes
2. Additional Material can be found on the course website (\[target=_blank\>http://teg.uwasa.fi/courses/ICATxxxx\])

**Teaching Methods**
lectures 24 h + Exercises 24 h+ independent work 84 h

**Modes of Study**
Exercises + Projects

### ICAT3100 ICAT Seminar, 3 cp

**Objectives**
the student is able search information on a given topic, analyse it critically and review it orally and textually. Course develops oral and written skills.

**Content**
depends on the chosen topic on ICAT area related to energy technology

**Study Materials**
depends on the chosen topic on ICAT area related to energy technology

**Teaching Methods**
lectures by the students, discussion, peer review by students

**Modes of Study**
lectures 24 h, self-study 40 h, peer review 10 h, independent work 7 h

**Teachers**
**Responsible Person:** prof. Jarmo Alander
**Teacher:** all ICAT professors

### ICAT3160 Security of Embedded and Distributed Systems, 7 cp

**Prerequisites**
It is highly recommended to know: Embedded System Architecture, and Embedded C programming.
### Objectives
The students who pass the course successfully will learn the Concepts of Cryptography, Types of Cyber Security Threats in Distributed Systems, to identify weak points of Embedded Systems, how to attack Embedded Systems (with practical examples), how to protect Embedded Systems, to apply Cryptographic Algorithms and the Concept of “Trusted Computing”. Course develops lifelong learning, Oral, written and interpersonal skills (Group Work, English), critical and analytical thinking, problem modeling and solving skills, IT skills and optimized decisions.

### Content

### Study Materials
1. Lecturer Notes

### Teaching Methods
lectures 38 h + Exercises 20 h + Independent work 128 h

### Modes of Study
Exam + Projects

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**ICAT3090 ICAT Project Work, 2-8 cp**

### Objectives
unprompted (independent) project planning and implementation of an individually chosen topic on ICAT area related to energy technology. Course develops lifelong learning and written skills (reporting).

### Content
case based: Independent project work done in industry or at university.

### Study Materials
case based

### Teaching Methods
self-study 54 - 216 h

### Modes of Study
independent study, work report