Modern Programming Concepts in Engineering

<table>
<thead>
<tr>
<th>Module-No./Abbreviation</th>
<th>Credits</th>
<th>Workload</th>
<th>Term</th>
<th>Frequency</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE-P04/MPCE</td>
<td>6 CP</td>
<td>180 h</td>
<td>1st Sem.</td>
<td>Winter term</td>
<td>1 Semester</td>
</tr>
</tbody>
</table>

Course
Modern Programming Concepts in Engineering

<table>
<thead>
<tr>
<th>Contact hours</th>
<th>Self-Study</th>
<th>Group Size:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 SWS (60 h)</td>
<td>120 h</td>
<td>No Restrictions</td>
</tr>
</tbody>
</table>

Prerequisites
No prior knowledge or preliminary modules.

Learning goals / Competences:
In this course, students acquire fundamental skills for the development of software solutions for engineering problems. This comprises the capability to analyze a problem with respect to its structure such that adequate object-oriented software concepts, data structures and algorithms can be applied and implemented. In this course Java is used as a programming language. The conveyed solution techniques can be easily transferred to other programming languages.

After successfully completing the module, the students
- will have acquired fundamental skills for the development of software solutions employed in engineering problems,
- are capable of analyzing a problem with respect to its structure such that adequate object-oriented software concepts, data structures and algorithms can be applied and implemented,
- are able to code typical engineering programs in the Java programming language,
- can quickly and efficiently learn further programming languages needed in engineering based on the fundamental concepts presented in the course.

Content
Lectures and exercises cover the following topics:
- Principles of object-oriented modeling
  - Encapsulation
  - Polymorphism
  - Inheritance
- Unified Modeling Language (UML)
- Basic programming constructs
- Fundamental data structures
- Implementation of efficient algorithms
  - Vector and matrix operations
  - Solving systems of linear equations
  - Grid generation techniques
- Using software libraries
  - View3d as visualization toolkit
  - Packages for graphical user interfaces

During the exercises, students practice object-oriented programming techniques in the computer lab on the basis of fundamental engineering problems.

Teaching methods / Language
Lecture (2h / week), Exercises (2h / week) / English

Mode of assessment
Written examination (120 min, 100%)

Requirement for the award of credit points
Passed final module examination

Module applicability
MSc. Computational Engineering
<table>
<thead>
<tr>
<th>Weight of the mark for the final score</th>
<th>4 %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module coordinator and lecturer(s)</strong></td>
<td>Prof. Dr.-Ing. M. König, Assistants</td>
</tr>
<tr>
<td><strong>Further information</strong></td>
<td></td>
</tr>
</tbody>
</table>