Hochschule Konstanz
University of Applied Sciences

Course number: MSI-AS 55012
Qauntum Computing
Study Level: Master / Graduate

Prof. Dr. B. Staehle
Language of Instruction: English
ECTS Credits: 5

The concept of quantum computing has been developed and researched on since the 1980s, but only increasingly, quantum computers gain the attention of a broader community. By following this lecture, students shall acquire both the theoretical foundations (linear algebra, physics, theoretical computer science) and the technical knowledge (quantum computer architectures, quantum algorithms) to gain a broad understanding of the topic. Working with and understanding state-of-the-art quantum development tools and projects completes the schedule to enable the students to play an active role in assessing and eventually using quantum technologies.

The students work in smalls teams to understand and present state-of-the-art tools, concepts and projects in the domain of quantum computing.

Contents:

Quantum Computing (Lecture / 3 ECTS)

- Algebra and Geometry of Complex Numbers, Complex Vector Spaces and Hilbert Spaces, Matrices and Vectors
- Basic Quantum Theory
- Bits and Qubits, Classical, Reversible and Quantum Gates
- Algorithms: Deutsch, Deutsch-Jozsa, Simon, Grover, Shor
- Advanced Topics: Tools, Cryptography, Hardware, …

Quantum Computing (Exercise / 2 ECTS)

- Pen & paper excercises for understanding the mathematics of quantum computing
- Case studies of quantum computing tools, application examples and research projects