UNIVERSITY OF PANNONIA

SUBJECT DATASHEET

Semester:	2009/10/1
Subject:	Introduction to quantum information
Code:	VEMKFISV12G
Responsible department:	Institute of Physics and Mechatronics
Responsible department code:	MKFI
Responsible lecturer:	dr. Péter Gurin

Educational objectives:

Introduction to the application of quatum mechanics in the informatics.

Detailed content of the subject:

1. What the heck is this quantum informatics? 2. Two state systems: classical and quantum bits. 3. Quantum phenomena: Einstein-Podolsky-Rosen paradox, entanglement, coherence and decoherence, unitarity, measurement. 4. The quantum phenomena in microscopic, mesoscopic and and macroscopic length scale. Basis of the information thery vs. Physics: Shannon and Neumann entropy. 5. Using of quantum mechanics for practical purposes: the basic idea of the quantum informatics. 6. Quantum teleportation: theory. 7. Quantum teleportation: experimental results. 8. Quantum communication and encryption: The BB84 protocol. The capacity of the quantum channel and the detection of an eavasdropper. 9. Decoherence and error correction.. 10. Models of machines: Turing machine, quantum logic gates. 11. Quantum algorithms and their complexity: Deutch's algorithm, Shor's algorithm. 12. More quantum algorithms: Simon's and Grover's searching algorithm. 13. From the interferometer to quantum computer: quantum hardware 1. The present. 14. Quantum hardware 2. the possible ways for the future. 15. Elctronics vs. Spintronics.

Requirements:

exam

Required and suggested references:

1. A.J. Leggett et al.: Fundamentals of Quantum Information: Quantum comtutation, communication, decoherence and all that, Lecture Notes in Physics, Springer, 2002. 2. G. Alber et al.: Quantum Information: An introduction to basic theoretical concepts and experiments, Springer Tracts in Modern Physics, Springer, 2001. 3. J. Perskill: Quantum Information (lecture notes), www.theory.caltech.edu/people/perskill/ph229/ #lecture 4. M. Oskin: Quantum Computing (lecture notes), www.cs.washington.edu/home/oskin/teaching.html