ЦЕНТЪР ЗА ОБУЧЕНИЕ – БАН

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Basic Information:
Course Title: Quantum Informatics
Lecturer: Assoc. Prof. Dr Lachezar Georgiev, Assoc. Prof. Dr Nikolay M. Nikolov
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Total Teaching Hours: 45

Annotation (up to 150 words)

Quantum Informatics is a modern research field, combining results from many fields: Quantum Mechanics, Quantum and Classical Statistics, Information Theory, Theory of Algorithms and others. The proposed course will focus on the physical principles of Quantum Theory that determine the applications in Quantum Informatics. A universal algebraic formulation of quantum statistics will be introduced, in which classical statistics is a special case. The laws of composite quantum statistical systems and the concept of quantum entanglement and Bell's inequalities will be formulated. Within the framework of the developed formalism, the connection with Information Theory and Theory of Algorithms will be traced and the concept of quantum algorithm will be introduced. The applications of quantum laws in the field of Quantum Communications and Quantum Cryptography will be considered. It is assumed that the students have basic knowledge in Mathematical Analysis and Algebra. The course is structured so that it is accessible both to students of mathematical specialties without prior knowledge in Quantum Physics, and to physicists to whom it will be presented a new look at Quantum Theory in accordance with information applications.

Course content (brief description by topics or modules)
Module 1: Principles of Quantum Information Science
Module 2: Quantum Algorithms and Quantum Computation
Module 3: Quantum Communication and Quantum Cryptography

Teaching and assessment methods
Lectures and presentations.
Written and oral examination.

Competencies acquired as a result of training (3–5 points)

1. Understanding of the principles of quantum theory.
2. Knowledge of quantum algorithms and quantum computation.
3. Understanding of the basic protocols of quantum cryptography.
4. Knowledge of quantum communication principles and technologies.

Literature:

1. Nielsen, Michael A.; Chuang, Isaac L. Quantum Computation and Quantum Information. Cambridge: Cambridge University Press, 2000
2. Kaye, Phillip; Laflamme, Raymond; Mosca, Michele. An Introduction to Quantum Computing. Oxford: Oxford University Press, 2007
3. Mermin, N. David. Quantum Computer Science: An Introduction. Cambridge: Cambridge University Press, 2007

Additional information (optional) (e.g., special requirements, laboratory equipment, prior knowledge)

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