



Joint Curricula

Advanced Quantum Technologies

Participating Institutions:

1. Kaiserslautern University of Technology (Kaiserslautern, Germany) – TUK
2. Kazan National Research Technical University named after A.N. TUPOLEV-KAI (Kazan, Russia) – KNRTU-KAI.

Duration of Study: 4 Semester, 2 years.

Place for Study:

Variant A — Starting at KNRTU-KAI

Variant B — Starting at TUK

1st, 2nd semesters at KNRTU-KAI,
3rd semester at TUK
4th semester at KNRTU-KAI or TUK.

1st, 2nd semesters at TUK,
3rd semester at KNRTU-KAI
4th semester at TUK or KNRTU-KAI.

Semester Plan (Variant A – Starting at KNRTU-KAI):

1st semester – Variant A

#	Course title	Module (TUK)	Credit Points (CPS)	Location	Course type
A.1.1	Quantum optics I	Quantum Technologies	3	Kazan, KNRTU-KAI	Compulsory
A.1.2	Quantum electronics	Quantum Technologies	5	Kazan, KNRTU-KAI	Compulsory
A.1.3	Quantum mechanics (advanced course)	Many-Body Quantum Systems	5	Kazan, KNRTU-KAI	Compulsory
A.1.4	Quantum Information Technology	Many-Body Quantum Systems	5	Kazan, KNRTU-KAI	Compulsory
A.1.5	Mathematical methods of computer simulations	Science Electives	4	Kazan, KNRTU-KAI	Compulsory
A.1.6	Information processing methods in photonics	General Electives	3	Kazan, KNRTU-KAI	Compulsory
A.1.7	Basics of research and project management	Research Module	3	Kazan, KNRTU-KAI	Compulsory
A.1.8	Quantum computing	Research Module	3	Kazan, KNRTU-KAI	Compulsory
	Total		31		

2nd semester – Variant A

#	Course title	Module (TUK)	Credit Points (CPS)	Location	Course type
A.2.1	Quantum optics II	Quantum Technologies	5	Kazan, KNRTU-KAI	Compulsory
A.2.2	Integral optics	Quantum Technologies	4	Kazan, KNRTU-KAI	Compulsory
A.2.3	Laboratory course in quantum optics	Laboratory Course	7	Kazan, KNRTU-KAI	Compulsory
A.2.4	Research project	Research Module	4	Kazan, KNRTU-KAI	Compulsory
A.2.5	Fiber optics	Science Electives	3	Kazan, KNRTU-KAI	Compulsory
A.2.6	English	General Electives	2	Kazan, KNRTU-KAI	Compulsory
A.2.7	Research project in quantum information	Research Module	4	Kazan, KNRTU-KAI	Compulsory
	Total		29		

3rd semester – Variant A

#	Course title	Module (TUK)	Credit Points (CPs)	Location	Course type
A.3.1	Elective course in Many-Body Quantum Systems	Many-Body Quantum Systems	12	Kaiserslautern, TUK	Elective
A.3.2	Specialized Scientific Seminar	Research Module	3	Kaiserslautern, TUK	Compulsory
A.3.3	Quantum Seminar	Research Module	3	Kaiserslautern, TUK	Compulsory
A.3.4	Research practice	Research Module	11	Kaiserslautern, TUK	Compulsory
A.3.5	Colloquium	Research Module	1	Kaiserslautern, TUK	Compulsory
Total			30		

4th semester – Variant A

#	Course title	Module (TUK)	Credit Points (CPs)	Location	Course type
A.4.1	Master Thesis	Master Thesis	30	Kazan, KNRTU-KAI or Kaiserslautern, TUK	Compulsory
Total			30		

Semester Plan (Variant B – Starting at TUK):

1st semester – Variant B

#	Course title	Module (TUK)	Credit Points (CPS)	Location	Course type
B.1.1	Coherent Optics	Quantum Technologies	4	Kaiserslautern, TUK	Compulsory
B.1.2	Semiconductor Quantum Structures	Quantum Technologies	4	Kaiserslautern, TUK	Compulsory
B.1.3	Advanced Quantum Mechanics	Many-Body Quantum Systems	4	Kaiserslautern, TUK	Compulsory
B.1.4	Quantum Information	Many-Body Quantum Systems	4	Kaiserslautern, TUK	Compulsory
B.1.5	Non-physics science course from any university department I	Science Electives	4	Kaiserslautern, TUK	Elective
B.1.6	Course from any university department I	General Electives	3	Kaiserslautern, TUK	Elective
B.1.7	Laboratory course	Laboratory Course	7	Kaiserslautern, TUK	Elective
Total			29		

2nd semester – Variant B

#	Course title	Module (TUK)	Credit Points (CPS)	Location	Course type
B.2.1	Quantum optics I	Quantum Technologies	4	Kaiserslautern, TUK	Compulsory
B.2.2	Quantum optics II	Quantum Technologies	4	Kaiserslautern, TUK	Compulsory
B.2.3	Non-physics science course from any university department I	Science Electives	4	Kaiserslautern, TUK	Elective
B.2.4	Course from any university department I	General Elective	3	Kaiserslautern, TUK	Elective
B.2.5	Research Module	Research Module	14	Kaiserslautern, TUK	Compulsory
Total			29		

3rd semester – Variant B

#	Course title	Module (TUK)	Credit Points (CPS)	Location	Course type
B.3.1	Quantum field theory	Many-Body Quantum Systems	8	Kazan, KNRTU-KAI	Compulsory
B.3.2	Quantum Technology	Many-Body Quantum Systems	4	Kazan, KNRTU-KAI	Compulsory
B.3.3	Scientific seminar	Research Module	6	Kazan, KNRTU-KAI	Compulsory
B.3.4	Research practice	Research Module	12	Kazan, KNRTU-KAI	Compulsory
B.3.5	Computational mathematics (Optional course)		2	Kazan, KNRTU-KAI	Optional
	Total		30(32)		

4th semester – Variant B

#	Course title	Module (TUK)	Credit Points (CPS)	Location	Course type
B.4.1	Master Thesis	Master Thesis	30	Kazan, KNRTU-KAI or Kaiserslautern, TUK	Compulsory
	Total		30		

Based on the above course plan, the participating institutions, TUK and KNRTU-KAI, agree on a joint curriculum in "Advanced Quantum Technologies", providing an attractive study program to acquire a master degree of both participating institutions. The curriculum consists of a set of courses that are mutually recognized and arranged in such a way that it is possible to study the curriculum in four semesters. The detailed description and course conformity are given in the amendment to this plan. This agreement implies that

1. a master degree from both institutions can only be received if the formal requirements of each institution's master program are fulfilled independently and all courses of the joint curriculum are studied.
2. applicants for the joint program need to fulfill the enrollment requirements of both institutions and require a formal acceptance from an admission committee of either institution. An applicant rejected by either of the institutions cannot receive a degree from the rejecting institution.
3. the curriculum is arranged symmetrically and can be started at either institution (variant A & B). The participating institutions agree that for the first two semesters, the students remain at the starting institution and have to spend at least the third semester at the foreign institution. The 4th semester (master thesis) can be spent at either institution.

Due to its exceptional importance for the scientific education, the participating institutions agree to have the master thesis formally registered at both institutions and to assign a supervisor from each institution.

On behalf of TU Kaiserslautern

Prof. Dr. Helmut J. Schmidt,
President

H.V.
Prof. Artur Wildera,
Coordinator of the MSc Program

On behalf of KNRTU-KAI

Prof. Albert Gilmudinov,
Rector

Prof. Sergey Moiseev,
Coordinator of the MSc Program

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J. Haduel M.D.

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