DEPARTMENT OF ENERGY SCIENCE AND TECHNOLOGIES
COURSE SYLLABUS

Course Details				
Code	**Academic Year**			**Semester**
EBT320	3			6
Title	**T**	**A**	**L**	**ECTS**
Advanced Quantum Energy Systems	3	1	0	6

Language	German					
Level	**Undergraduate**	**X**	**Graduate**		**Postgraduate**	
Department / Program	Energy Science and Technology					
Forms of Teaching and Learning	Face-to-face					
Course Type	**Compulsory**		**Elective**	**X**		
Objectives	This course aims to study quantum information and quantum energy systems, understand the function of quantum correlations in these systems, and evaluate their significance.					
Content	This course covers quantum information and quantum energy systems. Additionally, it includes quantum correlations, quantum circuits, and quantum noise operations.					
Prerequisites	None					
Coordinator	Assist. Prof. Dr. Elif Yunt					
Lecturer(s)	Assist. Prof. Dr. Elif Yunt					
Assistant(s)						
Work Placement	None					

Recommended or Required Reading	
Books / Lecture Notes	Thermodynamics in the Quantum Regime-Fundamental Aspects and New Directions, Felix Binder, Luis A. Correa, Gerardo Adesso, Fundamental Theories in Physics 195, Springer Quantenmechanik: Einführung, W. Greiner Thermodynamik und Statistische Mechanik, W. Greiner
Other Sources	Quantum Computation and Quantum Information, Micheal A. Nielsen and Isaac L. Chuang Quantum Thermodynamics: Emergence of Thermodynamic Behavior Within Composite Quantum Systems, Jochen Gemmer, M. Michel, G. Mahler,Lecture Notes in Physics, 2nd Ed. Springer

Additional Course Material	
Documents	
Assignments	
Exams	

Course Composition		
Mathematics und Basic Sciences		%

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Engineering	50	%
Engineering Design		%
Social Sciences		%
Educational Sciences		%
Natural Sciences	50	%
Health Sciences		%
Expert Knowledge		%

Assessment

Activity	Count	Percentage (%)
Midterm Exam	1	30
Quiz	4	20
Assignments	2	10
Attendance		
Recitations		
Projects		
Final Exam	1	40
	Total	**100**

ECTS Points and Work Load

Activity	Count	Duration	Work Load (Hours)
Lectures	14	3	42
Self-Study	10	10	100
Assignments	2	4	8
Presentation / Seminar Preparation			
Midterm Exam	1	2	2
Recitations	14	1	14
Laboratory			
Projects			
Final Exam	1	2	2
		Total Work Load	**168**
		ECTS Points (Total Work Load / Hours)	**6**

Learning Outcomes

1	The student can comprehend, explain, and interpret the postulates of quantum physics.
2	The student can understand, explain, and analyze quantum correlations and the concept of entanglement.
3	The student can comprehend, explain, and evaluate Quantum Information Theory.
4	The student can understand, explain, and apply the working principles of quantum circuits.

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5	The student learns how to evaluate energetic processes in the quantum regime.
6	The student learns how quantum correlations are used as a resource.
Weekly Content	
1	Fundamentals: Probability Theory and Linear Algebra
2	Vector Formalism I
3	Vector Formalism II
4	Postulates of Quantum Theory I
5	Postulates of Quantum Theory II
6	Density matrix theory
7	Quantum Correlations and Entanglement Measures
8	Midterm
9	Introduction to quantum information theory
10	Quantum correllations
11	Quantum circuits
12	Quantum noise
13	Quantum Operations
14	Distance Measures of quantum information theory
15	Energy perspective of quantum information systems
16	Final Exam

Contribution of Learning Outcomes to Program Objectives (1-5)

	P1	P2	P3	P4	P5	P6	P7	P8	P9
1	5	4	4	3	4	2	4	3	3
2	5	4	4	3	4	2	4	3	3
3	5	4	4	3	4	2	4	3	3
4	5	4	4	3	4	2	4	3	3
5	5	4	4	3	4	2	4	3	3

Contribution Level	1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High
Compiled by:	
Date of Compilation:	

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