ENERGY SCIENCE AND TECHNOLOGY BACHELOR PROGRAM

Course Details

Code	Academic Year			Semester
NWI202	4			8
Title	**T**	**A**	**L**	**ECTS**
Physical Chemistry II	3	1	1	6

Language	German					
Level	**Undergraduate**	x	**Graduate**		**Postgraduate**	
Department / Program	Energy Science and Technology					
Forms of Teaching and Learning	Formal					
Course Type	**Compulsory**	**X**	**Elective**			
Objectives	The aim is for students to understand the fundamental principles of reaction kinetics and quantum physics.					
Content	The topics include reaction kinetics, reaction mechanisms, surface chemistry, enzymatic reactions, catalysis, atomic models, wave-particle duality, wave function, Schrödinger equation, particle in a box, harmonic oscillator, hydrogen atom, and atomic structure.					
Prerequisites	None					
Coordinator	Dr. Öğr. Üyesi Samira Fatma Kurtoğlu Öztulum					
Lecturer(s)	Dr. Öğr. Üyesi Samira Fatma Kurtoğlu Öztulum					
Assistant(s)	None					
Work Placement	None					

Recommended or Required Reading

Books / Lecture Notes	Dr. Samira Fatma Kurtoğlu-Öztulum'nun ders notları
Other Sources	G. Wedler: Lehrbuch der Physikalischen Chemie; VCH, 5. Aufl., 2004. P.W. Atkins: Physikalische Chemie; VCH-Wiley, 4. Aufl., 2006. K. J. Laidler, J. H. Meiser, B. C. Sanctuary: Physical Chemistry; Cengage Learning, 4th Ed., 2003. H. S. Fogler: Elements of Chemical Reaction Engineering; Pearson, 4th Ed., 2006. D. O. Hayward: Quantum Mechanics for Chemists; Royal Society of Chemistry, 2002. D. J. Griffiths: Introduction to Quantum Mechanics; Pearson, 2nd Ed., 2014. J. R. Taylor, C. D. Zafiratos, M. A. Dubson: Modern Physics for Scientists and Engineers; University Science Books, 2nd Ed., 2015.

Additional Course Material

Documents	-
Assignments	-
Exams	1 Midterm, 1 Final

Course Composition

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Mathematics und Basic Sciences	40	%
Engineering	30	%
Engineering Design		%
Social Sciences		%
Educational Sciences	30	%
Natural Sciences		%
Health Sciences		%
Expert Knowledge		%

Assessment

Activity	Count	Percentage (%)
Midterm Exam	1	% 25
Quiz	5	% 5
Assignments	6	% 15
Attendance	0	% 0
Recitations	0	% 0
Projects	1	% 10
Final Exam	1	% 45
	Total	**100**

ECTS Points and Work Load

Activity	Count	Duration	Work Load (Hours)
Lectures	14	3	42
Self-Study	10	7	70
Assignments	6	2	12
Presentation / Seminar Preparation			
Midterm Exam	1	3	3
Recitations	14	1	14
Laboratory	14	1	14
Projects	1	10	10
Final Exam	1	3	3
		Total Work Load	**168**
		ECTS Points (Total Work Load / Hour)	**6**

Learning Outcomes

1	Determine the rate law of reactions.
2	Determine the rate law of chain reactions.
3	Calculate the activation energy of a reaction using the Arrhenius equation.

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4	Use the Langmuir isotherm to determine various adsorption parameters.
5	Calculate the surface area of a material using the BET isotherm.
6	Analyze reaction data to detect differences in various enzyme inhibitions.
7	Be knowledgeable about the historical development of atomic models.
8	Use the Schrödinger equation to solve simple quantum mechanical systems.
9	Apply the principles of quantum physics to obtain the thermodynamic properties of atoms.
Weekly Content	
1	Basic Definitions of Reaction Kinetics, Reaction Order, and Rate Laws
2	Temperature Dependence of the Rate Constant
3	Analysis of Kinetic Data: Integration Method and Half-Life Method
4	Transition State Theory, Collision Theory
5	Reaction Mechanisms, Chain Reactions
6	Surface Chemistry, Langmuir Adsorption Isotherm, Catalysis, Chemical Reactions on Surfaces
7	Enzymatic Reactions, Michaelis-Menten Equation, Enzyme Inhibition
8	Midterm Exam
9	Discovery of the Electron, Lorentz Forces, Thomson Atomic Model, Millikan Experiment, Rutherford Atomic Model
10	Blackbody Radiation, Photoelectric Effect, Compton Effect, Wave-Particle Duality, Emission and Absorption Spectra, Bohr Atomic Model, de Broglie Hypothesis, Wave Function, Heisenberg Uncertainty Principle
11	Time-Dependent and Time-Independent Schrödinger Equation
12	Basic Definitions of Probability and Statistics, Particle in a Box
13	Harmonic Oscillator
14	Hydrogen Atom, Quantum Numbers, Orbitals, Aufbau Principle
15	Thermodynamic Properties of a Monatomic Gas Obtained Using Quantum Statistics
16	Final Exam

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

	P1	P2	P3	P4	P5	P6	P7	P8	P9
Ö1	5	4	5	3	2	3	4	2	
Ö2	5	4	5	3	2	3	4	2	
Ö3	5	4	5	3	2	3	4	2	
Ö4	5	4	5	3	2	3	4	2	
Ö5	5	4	5	3	2	3	4	2	

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Ö6	5	4	5	3	2	3	4	2	
Ö7	5	4	5	3	2	3	4	2	
Ö8	5	2	3	2	2	3	5	2	
Ö9	5	2	5	2	2	3	5	2	

Contribution Level 1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High

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