

3rd Semester

Physical Chemistry

1. GENERAL			
SCHOOL	Faculty of Sciences in collaboration with Faculty of Engineering, Aristotle University of Thessaloniki		
DEPARTMENT	Materials Science and Engineering		
LEVEL OF STUDIES	ISCED level 7 (5-year Integrated Master's programme) ISCED level 6 (4-year BSc programme)		
COURSE CODE	MSEN 301	SEMESTER	3 rd Semester
COURSE TITLE	Physical Chemistry		
TEACHING ACTIVITIES	Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable), case studies and guided self-study.	TEACHING HOURS PER WEEK	ECTS CREDITS
		4 (3L + 1T)	6
COURSE TYPE	Background / General knowledge / Scientific area		
PREREQUISITES	MSEN 102 Fundamentals of Chemistry		
TEACHING AND EXAMINATION METHODS	Face-to-face lectures and guided problem-solving sessions; short in-class quizzes; final written examination.		
COURSE OFFERED TO ERASMUS STUDENTS	Yes.		
COURSE URL	https://elearning.auth.gr/course/view.php?id=xxxxx		

2. LEARNING OUTCOMES	
Learning Outcomes	<p>Knowledge</p> <p>After successfully completing the course, students will be able to:</p> <ul style="list-style-type: none"> • Explain the fundamental thermodynamic principles (energy, entropy, Gibbs free energy) governing the behavior of gases, liquids and solids. • Describe chemical and phase equilibria in multicomponent mixtures and analyze how temperature and pressure influence equilibrium. • Understand solution thermodynamics and electrolyte behavior, including ionic activity, colligative properties and the application of the Nernst equation. • Describe the fundamental principles of chemical kinetics and catalysis, with emphasis on reaction rates and mechanisms. <p>Skills</p> <p>Upon completion, students will be able to:</p>

	<ul style="list-style-type: none"> Apply thermodynamic, equilibrium and kinetic models to analyze the behavior and efficiency of elementary energy and environmental systems. <p>Abilities / Competences</p> <p>Students will develop the ability to:</p> <ul style="list-style-type: none"> Integrate thermodynamic, electrochemical and kinetic principles to interpret and predict the behavior of simple processes (e.g., electrolysis, catalytic reactions, gas-phase equilibria). Identify the physical-chemical factors (temperature, pressure, composition, phase changes, ionic strength)
General Skills	<ul style="list-style-type: none"> Problem solving with quantitative reasoning Teamwork Technical reporting and oral communication Searching, analyzing and synthesizing data and information Independent work Teamwork Promoting free, creative and inductive thinking Working in a multidisciplinary environment

3. COURSE CONTENT

This course introduces the essential principles of Physical Chemistry. Core topics include the thermodynamic properties of gases, liquids and solids; the First, Second and Third Laws of Thermodynamics; and chemical and phase equilibria in multicomponent systems. Students explore the properties of solutions and electrolytes, ionic activity, and introductory electrochemistry. Fundamental concepts of chemical kinetics, chemical reactions and catalysis are also covered, focusing on reaction rates, temperature effects and mechanisms.

4. LEARNING & TEACHING METHODS - EVALUATION

Teaching method	Face-to-face.
Use of ICT	<p>Use of ICT</p> <ul style="list-style-type: none"> Use of ICT in Teaching Use of ICT in Communication with students <p>Use of ICT – Description</p> <ul style="list-style-type: none"> elearning.auth.gr: educational materials available to students along with exercises Teaching with electronic presentations (slides, video, etc.) Communication via elearning.aut.gr and emails
Teaching organization	The supervised and unsupervised workload per activity is indicated below (total workload complies with ECTS standards).

	Activity	Workload/semester (hours)	ECTS
	Lectures	39	1.56
	Tutorials / problem sessions	13	0.52
	Bibliographic Research and analysis	10	0.4
	Independent study	70	2.8
	Exam preparation	16	0.64
	Final written exam	2	0.08
	Total	150	6
Student evaluation	<p>Assessment language The assessment language is English.</p> <p>Assessment methods The course uses the following methods:</p> <ul style="list-style-type: none"> • Multiple choice tests: three midterm exams to check recall of definitions, concepts, and terminology on core concepts of chemistry. • Problem solving assignments: three written assignments in which students review course material, analyze literature data, and solve problems on fundamentals of chemistry. • Final written exam: it combines short answers, problem solving, and data interpretation questions to evaluate cumulative understanding on core concepts of chemistry. <p>Weighting</p> <ul style="list-style-type: none"> • Multiple choice tests): 20% • Problem solving assignments: 20% • Final written exam: 60% <p>Student information Students are informed about the assessment process through:</p> <ul style="list-style-type: none"> • The course outline distributed in the first lecture. • Detailed instructions for the written assignment and presentation posted on the course website. • A dedicated assessment briefing during tutoring time where expectations and criteria are explained. 		

5. SUGGESTED BIBLIOGRAPHY

Course Bibliography

1. "Physical Chemistry", Peter Atkins, Julio de Paula, James Keeler, Oxford University Press, 2023
2. "Physical Chemistry for the Chemical Sciences", Raymond Chang, Jr. Thoman John W., University Science Books, 2014
3. "Physical Chemistry", David W. Ball, Cengage Learning, 2014

Additional bibliography for study

- Teaching material slides