CHEM 101 – ENGINEERING CHEMISTRY

Course Code	Course Name			Semester	
CHEM 101	ENGINEERING CHEMISTRY			Fall ☒ Spring ☐ Summer ☐	
Hours				Credit	ECTS
Theory	Practice	Lab		3	4
3	0	1			

Course Details	
Department	Nanotechnology Engineering
Course Language	English
Course Level	Undergraduate ☒ Graduate ☐
Mode of Delivery	Face to Face ☒ Online ☐ Hybrid ☐
Course Type	Compulsory ☒ Elective ☐
Course Objectives	The aim of this course is to provide engineering students with a solid foundation in the basic concepts of general chemistry, equipping them with the necessary skills to analyze and solve problems involving chemical principles relevant to engineering.
Course Content	Basic concepts of matter and atomic theory; chemical compounds and reactions; stoichiometry; gas laws; thermochemistry; atomic structure and periodic table; chemical bonding and molecular geometry; intermolecular forces and electrochemistry. Simulations, animations, and thought experiments are also integrated to enhance conceptual understanding and critical thinking.
Course Method/ Techniques	Lecture ☒ Question & Answer ☒ Presentation ☒ Discussion ☒
Prerequisites/ Corequisites	No
Work Placement(s)	No

Textbook/References/Materials
Main Textbook: Petrucci, R.H., Herring, F.G., Madura, J.D., Bissonnette, C. (General Chemistry: Principles and Modern Applications), Pearson Education. **Supplementary References:** - Zumdahl, S.S., Zumdahl, S.A. (Chemistry) - Chang, R., Goldsby, K. (Chemistry) - Atkins, P., Jones, L. (Chemical Principles)

Course Category				
Mathematics and Basic Sciences	☐		Education	☐
Engineering	☒		Science	☐
Engineering Design	☐		Health	☐
Social Sciences	☐		Profession	☐

Weekly Schedule		
No	**Topics**	**Materials/Notes**
1	**Introduction**: Why do we need to take this course? Matter and Its Properties, Atomic Theory	Chapters 1–2
2	**Chemical Compounds & Reactions**: Molecular, Ionic, Organic Compounds; Types of Reactions	Chapters 3–4
3	**Reactions in Aqueous Solutions I**: Precipitation, acid-base, redox reactions	Chapter 5
4	**Reactions in Aqueous Solutions II**: Solution stoichiometry, concentration calculations	Chapter 5
5	**Gases I**: Gas laws and ideal gas behavior	Chapter 6
6	**Gases II**: Kinetic molecular theory, real gases	Chapter 6
7	**Thermochemistry**: Heat, work, first law of thermodynamics	Chapter 7
8	**Midterm Exam**	
9	**Electrons in Atoms**: Quantum theory, electron configuration	Chapter 8
10	**The Periodic Table & Atomic Properties**: Periodicity, trends in properties	Chapter 9
11	**Chemical Bonding I**: Ionic and covalent bonding, Lewis structures	Chapter 10
12	**Chemical Bonding I (continued)**: Bond polarity, formal charges	Chapter 10
13	**Chemical Bonding II**: Molecular geometry, VSEPR, hybridization	Chapter 11
14	**Intermolecular Forces**: Properties of liquids and solids	Chapter 12
15	**Electrochemistry**: Galvanic cells, Nernst equation, applications	Chapter 19
16	**Final Exam**	

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance		
Lab	4	15
Practice		
Fieldwork		
Course-specific internship		
Quiz/Studio/Criticize	1	5
Homework		
Presentation / Seminar		
Project		
Report		
Seminar		
Midterm Exam	1	30
Final Exam	1	50
	Total	**100%**
Contribution of Midterm Studies to Success Grade	50	50
Contribution of End of Semester Studies to Success Grade	50	50
	Total	**100%**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hrs)**	**Total Workload**
Course Hours	14	3	42
Lab	4	1	4
Practice			
Fieldwork			
Course-specific Work Placement			
Out-of-class study time	14	2	28
Quiz/Studio/Criticize	1		
Homework			
Presentation / Seminar			
Project			
Report			
Midterm Exam and Preparation for Midterm	1	10	10
Final Exam and Preparation for Final Exam	1	16	16
Total Workload			**100**
Total Workload / 25			**100/25**
ECTS Credit			**4**

Course Learning Outcomes	
No	**Outcome**
L1	Learning the basic concepts of the general chemistry.
L2	Solving problems about the basic concepts.
L3	Being able to write experiment reports for a deeper understanding.
L4	Understanding the submicroscopic nature of chemistry by simulations and animations.
L5	Arguing the thought experiments so to become critical thinkers which is a basic need for engineering education.

Contribution of Course Learning Outcomes to Program Competencies/Outcomes

Contribution Level: 1: Very Slight, 2: Slight, 3: Moderate, 4: Significant, 5: Very Significant

	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**	**Total**
L1	5	4	1	2	1	1	1	3	1	1	2	22%
L2	5	5	2	3	2	1	1	3	1	1	2	26%
L3	4	4	2	3	4	2	4	3	2	1	3	32%
L4	5	4	2	4	3	1	1	3	1	1	3	28%
L5	4	5	3	3	2	2	2	4	2	2	3	32%
											Total	**140**

Program Outcomes

i. Adequate knowledge in mathematics, science and subjects specific to Engineering; ability to use theoretical and applied knowledge in these areas in complex engineering problems.

ii. Ability to identify, formulate and solve complex engineering problems; ability to select and apply appropriate analysis and modelling methods for this purpose.

iii. Ability to design a complex system, process, device or product under realistic constraints and conditions to meet specific requirements; ability to apply modern design methods for this purpose.

iv. Ability to develop, select and use modern techniques and tools required for the analysis and solution of complex problems encountered in engineering practice; ability to use information technologies effectively.

v. Ability to design and conduct experiments, collect data, analyse and interpret results in order to investigate complex engineering problems or research topics.

vi. Ability to work effectively in disciplinary and multidisciplinary teams; ability to work individually.

vii. Ability to communicate effectively in oral and written Turkish; knowledge of at least one foreign language; ability to write effective reports and understand written reports, to prepare design and production reports, to make effective presentations, to give and receive clear and understandable instructions.

viii. Awareness of the necessity of lifelong learning; the ability to access information, to follow developments in science and technology and to continuously renew oneself

ix. Acting in accordance with ethical principles, professional and ethical responsibility awareness; knowledge of standards used in engineering applications.

x. Knowledge about business life practices such as project management, risk management and change management; awareness of entrepreneurship, innovation; knowledge about sustainable development.

xi. Knowledge about the effects of engineering applications on health, environment and safety in universal and social aspects and the problems of the age reflected in the field of engineering; awareness of the legal implications of engineering solutions