# DEPARTMENT OF MATERIALS SCIENCE AND TECHOLOGY
# COURSE SYLLABUS

| Course Details | | | | |
|---|---|---|---|---|
| **Code** | **Academic Year** | | | **Semester** |
| NWI201 | 2 | | | 3 |
| **Title** | **T** | **A** | **L** | **ECTS** |
| Physical Chemistry I | 3 | 1 | 1 | 6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Language** | German | | | | | |
| **Level** | **Undergraduate** | **X** | **Graduate** | | **Postgraduate** | |
| **Department / Program** | Materials Science and Technology | | | | | |
| **Forms of Teaching and Learning** | Face to face | | | | | |
| **Course Type** | **Compulsory** | **X** | **Elective** | | | |
| **Objectives** | The students gain knowledge about the general principles for the description of physico-chemical contexts. They understand the basics of chemical and electrochemical equilibria and can apply them to different reactions. They are capable of independently performing and evaluating physical-chemical experiments. | | | | | |
| **Content** | General chemistry: Description of molecular interactions, ideal and real gases, gas mixtures, states of aggregation, single and binary systems with the phases gaseous / liquid / solid, substance separation;<br>Thermodynamics: Thermodynamic functions ( $\Delta$ U, $\Delta$ H, $\Delta$ S and $\Delta$ G), main theorems of thermodynamics and their application, cycles, the chemical potential, law of mass action: chemical and phase equilibria;<br>Electrochemistry: electrolyte equilibria, electrical conductivity of ions in solution, electrochemical equilibrium (Nernst equation), electrode reactions and galvanic cells. | | | | | |
| **Prerequisites** | | | | | | |
| **Coordinator** | | | | | | |
| **Lecturer(s)** | Asist Prof.Dr. Çağla Söz | | | | | |
| **Assistant(s)** | | | | | | |
| **Work Placement** | No | | | | | |

| Recommended or Required Reading | |
|---|---|
| **Books / Lecture Notes** | Bard A. J.,Faulkner L.R. „Electrochemical Methods:Fundamentals and Applications" , John Wiley & Sons, Inc., 2001 |
| **Other Sources** | Bechmann W., Schmidt J. „Einstieg in die Physikalische Chemie für Nebenfächler", Vieweg-Teubner Verlag, 2010<br>Atkins P., de Paulo J., „Physical Chemistry", W. H. Freeman and Company, 2006<br>Sarıkaya Y. „Fizikokimya", Gazi Kitabevi, 2000 |

| Additional Course Material | |
|---|---|
| **Documents** | |
| **Assignments** | |
| **Exams** | |

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| Course Composition | | |
|---|---|---|
| **Mathematics und Basic Sciences** | | 20% |
| **Engineering** | | % |
| **Engineering Design** | | % |
| **Social Sciences** | | % |
| **Educational Sciences** | | % |
| **Natural Sciences** | | 70% |
| **Health Sciences** | | % |
| **Expert Knowledge** | | 10% |

| Assessment | | |
|---|---|---|
| **Activity** | **Count** | **Percentage (%)** |
| **Midterm Exam** | 1 | 40 |
| **Quiz** | | |
| **Assignments** | 1 | 10 |
| **Attendance** | | |
| **Recitations** | | |
| **Projects** | 1 | 10 |
| **Final Exam** | 1 | 40 |
| **Total** | **4** | **100** |

| ECTS Points and Work Load | | | |
|---|---|---|---|
| **Activity** | **Count** | **Duration** | **Work Load (Hours)** |
| **Lectures** | 14 | 3 | 42 |
| **Self-Study** | 14 | 6 | 84 |
| **Assignments** | 5 | 3 | 15 |
| **Presentation / Seminar Preparation** | | | |
| **Midterm Exam** | 1 | 2 | 2 |
| **Recitations** | 14 | 1 | 14 |
| **Laboratory** | 14 | 1 | 14 |
| **Projects** | | | |
| **Final Exam** | 1 | 2 | 2 |
| | | **Total Work Load** | **173** |
| | | **ECTS Points** (Total Work Load / Hours) | **6** |

| Learning Outcomes | |
|---|---|
| **1** | To be able to solve the reaction rate and the reaction constant |
| **2** | To be ablo to determine the effect of concentration, temperature, and time on the reaction rate |

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| | |
|---|---|
| **3** | To learn the behavior of real and ideal gases |
| **4** | To learn the laws of thermodynamic. |
| **5** | To perform calculations with thermodynamic variables |
| **6** | To determine the properties of a system by using the thermodynamic variables |
| **7** | To understand the equilibrium of a system by using the thermodynamic variables |
| **8** | To be able to interpret phase diagrams,; to be able to draw phase diagrams by using the required information |
| **9** | To understand electrochemical cells and to be able to write the equations for the electrochemical reactions |
| **10** | |
| **11** | |
| **12** | |

| **Weekly Content** | |
|---|---|
| **1** | Reactionskinetic: Basics and definitions Rules for reaction rates |
| **2** | Combined reaktions Approximation method Temperature dependence of reaction rate |
| **3** | Thermodynamic: basic concepts Temperature and the 0th law of thermodynamics |
| **4** | Real Gases İdeal Gases |
| **5** | Laboratory: Thermochemistry- To determine principles of calorimetry |
| **6** | Work, heat , energy The 1st rule of thermodynamics Cyclic prozesses, Carnot cycle state functions |
| **7** | Enthalpy, The Joule Thomson Effect, The 2nd law of thermodynamics, entrophy Laboratory: Thermochemistry-Part II |
| **8** | The third law of thermodynamics, The Helmholtz and Gibbs Energies, Maxwell relations |
| **9** | Laboratory: To calculate the distribution coefficent of ammonia between water and chlorofom |
| **10** | Laboratory: Experiment on solubility of solids to calculate the enthalpy value by using the Gibbs Helmholtz equation |
| **11** | Phase diagrams Phase stability and Phase transitions |
| **12** | Phase stability and phase transitions continued The thermodynamic description of mixtures The properties of solutions |
| **13** | Activities |
| **14** | Spontaneous chemical reactions The response of equilibria to the conditions Equilibrium electrochemistry |
| **15** | |

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

| | **P1** | **P2** | **P3** | **P4** | **P5** | **P6** | **P7** |
|---|---|---|---|---|---|---|---|
| **1** | 4 | 5 | 5 | 1 | 1 | 5 | 5 |
| **2** | 4 | 5 | 5 | 1 | 1 | 5 | 5 |
| **3** | 2 | 5 | 5 | 1 | 1 | 5 | 5 |
| **4** | 2 | 5 | 5 | 1 | 1 | 5 | 5 |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **5** | 5 | 5 | 5 | 1 | 1 | 5 | 5 |
| **6** | 5 | 4 | 5 | 1 | 1 | 5 | 5 |
| **7** | 3 | 4 | 5 | 1 | 1 | 5 | 5 |
| **8** | 3 | 5 | 5 | 1 | 1 | 5 | 5 |
| **9** | 5 | 5 | 5 | 1 | 1 | 5 | 5 |
| **Contribution Level** | 1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High | | | | | | |
| | | | | | | | |
| **Compiled by:** | | | | | | | |
| **Date of Compilation:** | | | | | | | |