Enquiry for Course Details

CHEM2541 Introductory physical chemistry (6 credits)		Academic Year	2023
Offering Department	Chemistry	Quota	100
Course Co-ordinator	Dr J Y Tang, Chemistry < jinyao@hku.hk >		
Teachers Involved	(Dr J Y Tang/(Visiting Professor) Dr X H Yan,Chemistry)		
Course Objectives	The course aims to provide a rigorous understanding of equilibrium thermodynamics and chemical kinetics. Students are required to apply mathematical skills (derivations, integrations, and statistics) and fundamental physics to understand chemical reactions and related processes. Topics include the three laws of thermodynamics, thermodynamic properties of mixtures, solutions, chemical equilibrium, electrochemistry, rates of chemical reactions and reaction dynamics. Students will gain a good foundation of knowledge and skills for further study in advanced Physical Chemistry. Due to the involvement of math knowledge in this course, students are strongly encouraged to enroll in CHEM1044 Mathematics in chemistry, before enrolling in this course, if possible. An adequate maths background should benefit students in getting more learning this course.		
Course Contents & Topics	The First Law of Thermodynamics Basic concepts of work, heat, energy, expansion work, heat transactions, enthalpy and adiabatic changes and examples in relation to biochemistry and materials science. The Second and Third Laws of Thermodynamics Direction of spontaneous change, entropy and the Third Law of Thermodynamics. Gibbs relationships and the development of thermodynamics to material science, information sciences. The application of three laws of thermodynamics for classical systems as well as new applications. Simple Mixtures The thermodynamics of phase equilibrium and surface. Thermodynamic description of mixtures, partial molar quantities, and chemical potentials of liquids. Activities of solvent, solute, regular solutions and ions in solution. The example in binary mixture will be discussed. Chemical Equilibrium Spontaneous chemical reactions, the Gibbs energy minimum and equilibrium. Response of equilibria to pressure, temperature. Electrochemistry Electrochemical cell, relationship of electrochemical potential to thermodynamic functions. Applications of electrochemistry in energy, material science, sensing. Rates of Chemical Reactions Empirical chemical kinetics including experimental methods, rates of reactions, integrated rate laws and temperature dependence of reactions and Reaction mechanism. The electrochemistry dynamics and basic knowledge in enzyme chemistry.		
Course Learning Outcomes	On successful completion of this course, students should be able to: CLO 1 demonstrate knowledge and understanding of the properties of gases, molecules in motion and the rates of chemical reactions CLO 2 understand and demonstrate knowledge of the three laws of thermodynamics CLO 3 understand and apply the concepts of chemical equilibrium and the response of chemical equilibria to temperature and pressure CLO 4 understand and demonstrate knowledge of electrochemistry and its relationship to thermodynamics, can build electrochemical cell and calculate thermodynamic functions from electrochemical reactions CLO 5 demonstrate knowledge and understanding of basic reaction dynamics including reaction mechanism and how mechanism determines reaction rate law		
Pre-requisites (and Co-requisites and Impermissible combinations)	Pass in CHEM1042 and CHEM1043 Student are recommended (but not required) to take CHEM1044 before (or along with) taking this course.		
Course Status with Related Major/Minor /Professional Core	2023 Major in Chemistry (Core/Compulsory) 2023 Major in Chemistry (Intensive) (Core/Compulsory) 2023 Minor in Chemistry (Disciplinary Elective) 2022 Major in Chemistry (Core/Compulsory) 2022 Major in Chemistry (Intensive) (Core/Compulsory) 2022 Minor in Chemistry (Disciplinary Elective) 2021 Major in Chemistry (Core/Compulsory) 2021 Major in Chemistry (Intensive) (Core/Compulsory) 2021 Minor in Chemistry (Disciplinary Elective) 2020 Major in Chemistry (Core/Compulsory) 2020 Major in Chemistry (Intensive) (Core/Compulsory) 2020 Minor in Chemistry (Disciplinary Elective) 2019 Major in Chemistry (Core/Compulsory) 2019 Major in Chemistry (Intensive) (Core/Compulsory) 2019 Minor in Chemistry (Disciplinary Elective)		

Course to PLO Mapping	2023 Major in Chemistry < PLO 1,2,3,5 > 2023 Major in Chemistry (Intensive) < PLO 1,2,3,5 > 2022 Major in Chemistry < PLO 1,2,3,5 > 2022 Major in Chemistry (Intensive) < PLO 1,2,3,5 > 2021 Major in Chemistry < PLO 1,2,3,5 > 2021 Major in Chemistry (Intensive) < PLO 1,2,3,5 > 2020 Major in Chemistry < PLO 1,2,3,5 > 2020 Major in Chemistry (Intensive) < PLO 1,2,3,5 > 2019 Major in Chemistry < PLO 1,2,3,5 > 2019 Major in Chemistry (Intensive) < PLO 1,2,3,5 >
Offer in 2023 - 2024	Y 2nd sem — Examination: May
Offer in 2024 - 2025	Y
Course Grade	A+ to F

Grade Descriptors

A	Demonstrate thorough mastery at an advanced level of extensive knowledge and skills required for attaining all the course learning outcomes. Show thorough grasp of the subject. Demonstrate strong analytical and critical abilities and logical thinking, with ability to apply knowledge to a wide range of complex, familiar and unfamiliar situations.
B	Demonstrate substantial command of a broad range of knowledge and skills required for attaining at least most of the course learning outcomes. Show substantial grasp of the subject. Demonstrate evidence of analytical and critical abilities and logical thinking, and ability to apply knowledge to familiar and some unfamiliar situations.
C	Demonstrate general but incomplete command of knowledge and skills required for attaining most of the course learning outcomes. Show general but incomplete grasp of the subject. Demonstrate evidence of some analytical and critical abilities and logical thinking, and ability to apply knowledge to most familiar situations.
D	Demonstrate partial but limited command of knowledge and skills required for attaining some of the course learning outcomes. Show partial but limited grasp, with retention of some relevant information, of the subject. Demonstrate evidence of some coherent and logical thinking, but with limited analytical and critical abilities. Show limited ability to apply knowledge to solve problems.
Fail	Demonstrate little or no evidence of command of knowledge and skills required for attaining the course learning outcomes. Show evidence of little or no grasp of the knowledge and understanding of the subject. Lack of analytical and critical abilities, logical and coherent thinking. Show very little or no ability to apply knowledge to solve problems.

Course Type: Lecture-based course

Course Teaching & Learning Activities

Activities	Details	No. of Hours
Lectures		36
Tutorials		12
Reading / Self study		100

Assessment Methods and Weighting

Methods	Details	Weighting in final course grade (%)	Assessment Methods to CLO Mapping
Assignments	(30% Assignments; 5% participation)	35	CLO 1,2,3,4,5
Examination		45	CLO 1,2,3,4,5
Test		20	CLO 1,2

Required/recommended reading and online materials: Required textbook: 'Physical Chemistry' by P. W. Atkins, latest edition
Recommended Book: 'Physical Chemistry' 6th edition by Ira N. Levine

Course Website: NIL

Additional Course Information: