School of Chemistry
Faculty of Science
University of the Punjab, Lahore
Course Outline

BS Chemistry Semester-IV					
Programme	**BS Chemistry**	**Course Code**	**Chem-201**	**Credit Hours**	**2**
Course Title	**Chemical Kinetics**		**Course Type**	**Major**	

Course Introduction

This course covers the principles of chemical kinetics, including rate laws, reaction orders, and third-order reactions. Students will study the kinetics of various reactions, the effect of temperature, and the mathematical treatments of collision theory and transition state theory. The course also includes calculating entropy and enthalpy using the Eyring equation and examining the impact of ionic strength and hydrostatic pressure on reaction rates.
Here is a brief description of course outlines.
Concept of rate law and order of reaction, Kinetics of 3rd order reaction with different concentrations and molecular identity, kinetics of opposing, parallel and consecutive reactions, basic experimental methods, Kinetics of thermally excited chain reactions like reaction of H_2 and Br_2, kinetics of thermal decomposition of ozone, N_2O_5 and CH_3CHO.
Effect of temperature on reaction rate, mathematical treatment of collision theory and transition state theory of bimolecular reactions, Comparison of collision theory and Transition state theory with Arrhenius theory, Calculation of entropy and enthalpy by Eyring equation, effect of ionic strength and hydrostatic pressure on the rate of reaction in solution.

Learning Outcomes

On the completion of the course, the students will:
1. Understand and apply rate laws and reaction orders, including third-order reactions.
2. Analyze the kinetics of opposing, parallel, and consecutive reactions, as well as thermally excited chain reactions and thermal decomposition processes.
3. Evaluate the effect of temperature on reaction rates and compare collision theory, transition state theory, and Arrhenius theory.
4. Calculate entropy and enthalpy using the Eyring equation.
5. Assess the impact of ionic strength and hydrostatic pressure on reaction rates in solutions.

	Course Content	Assignments/Readings
Week 1	Unit-Chemical Kinetics Concept of rate law and order of reaction	
	Kinetics of 3rd order reaction with different concentrations and molecular identity	
Week 2	Continued	
	Continued	
Week 3	Kinetics of opposing reactions	
	Continued	
Week 4	Continued	
	Continued	
Week 5	Kinetics of parallel reactions	

	Continued	
Week 6	Continued	
	Kinetics of consecutive reactions	
Week 7	Continued	
	Steady State Approximation	
Week 8	**Mid Term Examinations**	
Week 9	Kinetics of thermal decomposition of ozone, N_2O_5 and CH_3CHO and combination of H_2 and Br_2.	
	Continued	
Week 10	Continued	
	Continued	
Week 11	Basic experimental methods	
	Effect of temperature on reaction rate	
Week 12	Mathematical treatment of collision theory)	
	Mathematical treatment of transition state theory of bimolecular reactions (Eyring equation Effect of hydrostatic pressure on rate of reaction	
Week 13	Continued	
	Effect of ionic strength on rate of reaction in solution	
Week 14	Effect of hydrostatic pressure on the rate of reaction in solution	
	Continued	
Week 15	Relaxation methods of kinetics	
	Continued	
Week 16	**Final Term Examinations**	

Textbooks and Reading Material

1. Bhatti, H. N. and Farooqi, Z. H., Modern Physical Chemistry, Revised ed., Caravan Book House, Lahore, 2014.
2. Brouard, M., Reaction Dynamics, Oxford University Press, New York, 1998.
3. Espenson, J. H., Chemical Kinetics and Reaction Mechanism, 2nd edition, WCB/McGraw-Hill, New York, 1995.
4. Hammes, G. G., Principles of Chemical Kinetics, Academic Press, New York, 1976.
5. Houston, P. L., Chemical Kinetics and Reaction Dynamics, McGraw-Hill, Dubuque, IA, 2001.
6. Laidler, K. J., Chemical Kinetics, 3rd ed., Harper & Row, New York.
7. Physical…..?

Teaching Learning Strategies
1. Lectures 2. Group Discussion 3. Laboratory work 4. Seminar/ Workshop

Assignments: Types and Number with Calendar
1. Numerical problem sets relevant to topic will be given as assignments from week 1 to week 16. **2.** Literature review based assignment relevant to the course will also be given during the course.

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

BS Chemistry Semester-IV					
Programme	**BS Chemistry**	**Course Code**	**Chem-202**	**Credit Hour**	**1**
Course Title	**Physical Chemistry Lab**		**Course Type**	**Major**	

Course Introduction

This course covers various experimental techniques for analyzing chemical reactions, including polarimetry, spectrophotometry, and kinetics studies.
Here is a brief description of course outlines:
Determination of angle of rotation of an optically active substance.
Determination of percentage composition of a binary solution of glucose/sucrose by polarimetery.
Determination of specific rotation of given optically active substance.
Study of kinetics of inversion of cane sugar using polarimetric method.
Determination of concentration of colored substance by spectrophotometry.
Study of kinetics of iodination of acetone using UV Visible Spectrophotometry.
Kinetics of the reaction between methyl orange and peroxodisulphate ions in presence of bromide ions.
Investigation of the kinetics of hydrolysis of ethyl acetate in the presence of an acid.
Determination of the relative strength of acids (HCl and H_2SO_4) by studying the hydrolysis of an ester.
Determination of the eutectic point of a binary mixture (Naphthalene and diphenyl, urea and phenol, benzoic acid and naphthalene) system.

Learning Outcomes

On the completion of the course, the students will be able:

1. to accurately determine the optical rotation and specific rotation of optically active substances,
2. analyze the kinetics of reactions using polarimetry and spectrophotometry,
3. Evaluate the relative strengths of acids and the eutectic points of binary mixtures through practical experimentation.

Course Content		Assignments/Readings
Week 1	Determination of angle of rotation of an optically active substance.	
	Continued	
Week 2	Continued	
	Determination of percentage composition of a binary solution of glucose/sucrose by polarimetry.	
Week 3	Continued	
	Continued	
Week 4	Determination of specific rotation of given optically active substance.	
	Continued	
Week 5	Continued	
	Study of kinetics of inversion of cane sugar using polarimetric method.	

Week 6	Continued	
	Determination of concentration of colored substance by spectrophotometry.	
Week 7	Continued	
	Continued	
Week 8	**Mid Term Examinations**	
Week 9	Study of kinetics of iodination of acetone using UV Visible Spectrophotometry.	
	Continued	
Week 10	Kinetics of the reaction between methyl orange and peroxodisulphate ions in presence of bromide ions.	
	Continued	
Week 11	Continued	
	Investigation of the kinetics of hydrolysis of ethyl acetate in the presence of an acid.	
Week 12	Continued	
	Continued	
Week 13	Determination of the relative strength of acids (HCl and H_2SO_4) by studying the hydrolysis of an ester.	
	Continued	
Week 14	Continued	
	Determination of the eutectic point of a binary mixture (Naphthalene and diphenyl, urea and phenol, benzoic acid and naphthalene) system.	
Week 15	Continued	
	Continued	
Week 16	**Final Term Examinations**	

Textbooks and Reading Material

1. Garland, C. W., Nibler, J. W., Shoemaker, D. P., Experiments in Physical Chemistry, 6th ed., WCB McGraw-Hill,1996.
2. Singh, A., Advanced Experimental Physical Chemistry, Campus Books International, 2007.
3. Daniels F., Experimental Physical Chemistry, 7th ed., McGraw-Hill College, 1970.
4. Matthews, G. P., Experimental Physical Chemistry, Oxford University Press, 1986.
5. Bhatti, H. N. & Farooqi, Z. H., Experimental Physical Chemistry for Graduate and Postgraduate Students, Revised ed., Caravan Book House, Lahore, 2014.

Teaching Learning Strategies
1. Lectures 2. Group Discussion 3. Laboratory work 4. Seminar/ Workshop
Assignments: Types and Number with Calendar
1. Lab activities and practical performance from week 1 to week 16. 2. Literature review based assignment relevant to the course will also be given during the course.

Assessment

Sr. No.	Elements	Weightage	Details
4.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
5.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
6.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.