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

BS Chemistry Semester-I					
Programme	**BS Chemistry**	**Course Code**	**Chem-101**	**Credit Hours**	**2**
Course Title	**Physical Chemistry-I**		**Course Type**	**Major**	

Course Introduction

The course is organized to provide an adequate knowledge about basic concepts in Physical chemistry including thermodynamics, chemical kinetics etc.
Here is a brief description of course outlines.
Chemical Thermodynamics: Equation of states, ideal and real gases, the Vander Waals equation for real gases, critical phenomena and critical constants. types of thermodynamic systems and processes, concept of work, heat and internal energy, first law of thermodynamics, isothermal expansion of an ideal gas, concept of enthalpy and heat capacity, relation between C_p and C_v, adiabatic expansion of an ideal gas.
Chemical Kinetics: Derivation of kinetics expression of zero order, first order, second order (with same and different concentrations), nuclear decay and bacterial growth as first order reaction, determination of rate constant and half-life period for 1^{st} order and 2^{nd} order reactions, Arrhenius equation and determination of various Arrhenius parameters.
Liquids, Solids, solutions and Colloids: Physical properties of liquids (surface tension, viscosity, refractive index etc.), structures and properties of solids, X-ray crystallography and Brag's equation. Vapor pressure of liquid and solution, temperature dependence of vapor pressure of a liquid, solutions, colligative properties and their applications. Concept of colloids, classification of colloids (Sol, emulsion and gel), dialysis, electro-dialysis, sedimentation, precipitation, ultra-filtration, Tyndall cone effect.
Surface Chemistry: Interface, Adsorption, types of adsorption at liquid surface, adsorption isotherms (Freundlich and Langmuir), heterogeneous catalysis and kinetics of enzyme catalysis.

Learning Outcomes

On the completion of the course, the students will:

1. learn the key concepts of physical chemistry
2. understand key physical chemistry chapters like thermodynamics, kinetics etc.

Course Content		Assignments/Readings
Week 1	**Unit-I Chemical Thermodynamics** Equation of states, ideal and real gases, the Vander Waals equation for real gases,	
	critical phenomena and critical constants types of thermodynamic systems and processes	
Week 2	Concept of work, heat and internal energy. First law of thermodynamics	

	Isothermal expansion of an ideal gas Concept of enthalpy and heat capacity	
Week 3	Relation between C_p and C_v,	
	Adiabatic expansion of ideal gas	
Week 4	**Unit II-Chemical Kinetics** Derivation of kinetics expression of zero order,	
	Kinetics of first order	
Week 5	Nuclear decay and bacterial growth as first order	
	Kinetics of second order (with same concentrations)	
Week 6	Kinetics of second order (with different concentrations)	
	Determination of rate constant and half-life period for 1st order and 2nd order reactions	
Week 7	Arrhenius equation	
	Determination Arrhenius parameters.	
Week 8	**Mid Term Examinations**	
Week 9	**Unit-III Liquids, Solids, solutions and Colloids** Physical properties of liquids including surface tension, viscosity, refractive index etc.)	
	Continued	
Week 10	Structures and properties of solids	
	X-ray crystallography and Brag's equation.	
Week 11	Vapor pressure of liquid and solution temperature dependence of vapor pressure of a liquid	
	Raoult's law Concept of colloids, classification of colloids (Sol, emulsion and gel)	

Week 12	Purification of colloids by dialysis, Purification of colloids by electro-dialysis, Sedimentation of colloids,	
	precipitation of colloids, ultra-filtration of colloids, Tyndall cone effect	
Week 13	**Unit-IV Surface Chemistry** Interface, Adsorption Types of adsorptions	
	adsorption isotherms (Freundlich), adsorption isotherms (Langmuir),	
Week 14	Heterogeneous catalysis	
	Continued	
Week 15	kinetics of enzyme catalysis.	
	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, 2014.
2. Bahl B.S., Tuli G.D., Bahl, H. Essentials of Physical Chemistry, S. Chand & Co., 2000.
3. Alberty, R. A. and Silbey, R. J. Physical Chemistry, 3rd ed., John Wiley & Sons, Inc., New York, 2001.
4. Atkins, P. W., Physical Chemistry, 7th ed., W. H. Freeman and Company, New York, 2002.
5. Chang, R., Physical Chemistry the Chemical and Biological Sciences, 3rd ed., University Science Books, Sausalito, CA, 2000.
6. Laidler, K. J., Meiser, J. H., and Sanctuary, B. C., Physical Chemistry, 4th ed., Houghton Mifflin Company, Boston, 2002.
7. Levine, I. N., Physical Chemistry, 5th ed., McGraw-Hill, Inc., New York, 2002. Winn, J. S., Physical Chemistry, Harper Collins College Publishers, New York, 1995.
8. Noggle, J. H., Physical Chemistry, Harper Collins College Publishers, New York, 1996.

Teaching Learning Strategies

1. Lectures
2. Group Discussion
3. Laboratory work/Numerical problem sets
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-I					
Programme	**BS Chemistry**	**Course Code**	**Chem-102**	**Credit Hour**	**1**
Course Title	**Physical Chemistry Lab**		**Course Type**	**Major**	

Course Introduction

The course is organized to provide an adequate knowledge about basic concepts in Physical chemistry including thermodynamics, chemical kinetics etc.
Here is a brief description of course outlines.
Preparation of standard molar, molal and percentage solutions.
Standardization of secondary standard acids and bases solutions by volumetric methods.
Determination of surface tension of a liquid.
Determination of parachor value of given liquid.
Determination of viscosity of given liquid.
Determination of rheochor value of given liquid.
Determination of refractive index of given liquid.
Determination of molar refractivity of given liquid.
Determination of percentage composition by refractive index method.

Learning Outcomes

On the completion of the course, the students will:

1. To introduce students about the key concepts of physical chemistry
2. To introduce about thermodynamics, chemical kinetics etc.

	Course Content	Assignments/Readings
Week 1	Preparation of standard molar, molal and percentage solutions	
	Continued	
Week 2	Standardization of secondary standard acids and bases solutions by volumetric methods.	
	Continued	
Week 3	Continued	
	Determination of surface tension of a liquid.	
Week 4	Continued	
	Continued	
Week 5	Determination of parachor value of given liquid	
	Continued	
Week 6	Continued	
	Determination of viscosity of given liquid	
Week 7	Continued	
	Continued	

Week 8	**Mid Term Examinations**	
Week 9	Determination of rheochor value of given liquid	
	Continued	
Week 10	Continued	
	Continued	
Week 11	Determination of refractive index of given liquid.	
	Continued	
Week 12	Continued	
	Continued	
Week 13	Determination of molar refractivity of given liquid.	
	Continued	
Week 14	Determination of percentage composition by refractive index method	
	Continued	
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. and 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**
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.