ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name : B.Sc. (Hons) Chemistry						
Semester	**Course Code**	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Credit (C)**
IV (Sec-A & B)	CHEMISTRY-CX PHYSICAL CHEMISTRY–IV	Course Title: Conductance & Chemical Kinetics	4		0	4
Teacher/Instructor(s)		Mr. Vishnu Kumawat Dr. Meenakshi Gupta,				
Session		2022-23				

Course Description:

Objectives: This course aims to make the students understand conductance, anomaly of strong electrolytes, laws governing migration of ions in solutions and application of conductance measurement for titration methods and have understanding of kinetics of chemical reaction, catalysis and photochemical reactions.

Learning Outcomes:

By the end of this course, students will be able to:

•Explain the chemistry of conductance and its variation with dilution, migration of ions in solutions.

• Learn the applications of conductance measurements,

• Have understanding of rate law and rate of reaction, theories of reaction rates and catalysts; both chemical and enzymatic

• Have knowledge of the laws of absorption of light energy by molecules and the subsequent photochemicalreactions.

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be covered
1.	Conductance	1-2	Quantitative aspects of Faraday's laws of electrolysis, Arrhenius theory of electrolytic dissociation.
		3-4	Conductivity: equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes.
		5-6	Molar conductivity at infinite dilution. Kohlrausch's law of independent migration of ions.
		7-8	Debye-Huckel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rule.
		9-10	Ionic velocity, mobility and their determination, transference number and its relation to ionic mobility

		11-12	Determination of transference number using Hittorf and Moving Boundary methods.
		13-14	Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts,
		15-16	(iv) conductometric titrations, (v) hydrolysis constants of salts.
		17-18	Test for internal aasesment
2.	Chemical Kinetics	1- 2	Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction
		3-4	Differential and integrated form of rate expressions up to second order reactions
		5-6	Experimental methods for determination of rate laws
		7-8	kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions
		9-10	(ii) parallel reactions
		11-12	(iii) Consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions.
		13-14	Temperature dependence of reaction rates; Arrhenius equation; activation energy
		15-16	Collision theory of reaction rates
		17-18	Lindemann mechanism
		19-20	Qualitative treatment of the theory of absolute reaction rates
		21-22	Last year Question paper discussion and problem solving
3.	Catalysis	1-2	Types of catalyst, specificity and selectivity
		3-4	Mechanisms of catalyzed reactions at solid surfaces.
		5-6	Enzyme catalysis, Michaelis-Menten mechanism
		7-8	Acid-base catalysis
4.	Photochemistry	1- 2	Characteristics of electromagnetic radiation, Jablonski Diagram. Lambert-Beer's law and its limitations,
		3-4	Physical significance of absorption coefficients.
		5-6	Laws of photochemistry, quantum yield, actinometry, examples of low and high quantum yields,
		7-8	Photochemical equilibrium and the differential rate of photochemical reactions,
		9-10	Photosensitized reactions, quenching. Role of photochemical reactions in biochemical processes,.
		11-12	Photostationary states, chemiluminescence. Jablonsky diagram

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment		25
	• Quiz		
	• Class Test		

	• Attendance • Assignment		
2.	End Semester Examination	3 hr.	75

Details of the Course		
Unit	**Contents**	**Contact Hours**
I	**Conductance:** Quantitative aspects of Faraday's laws of electrolysis, Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch's law of independent migration of ions. Debye-Huckel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rule. Ionic velocity, mobility and their determination, transference number and its relation to ionic mobility, determination of transference number using Hittorf and Moving Boundary methods. Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations,(v) hydrolysis constants of salts.	18
II	**Chemical Kinetics:** Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods for determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions. Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates.	22
III	**Catalysis:** Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.	8
IV	**Photochemistry:** Characteristics of electromagnetic radiation, Jablonski Diagram. Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitized reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence. Jablonsky diagram.	12
	Total	**60**

Suggested Books:

Sl. No.	Name of Authors/Books/Publishers	Year of Publication/ Reprint

1.	Atkins, P.W.; Paula, J.de. (2014),Atkin's Physical Chemistry Ed., 10th Edition, Oxford University Press.	2014
2.	Kapoor, K.L.(2015),A Textbook of Physical Chemistry,Vol 1, 6th Edition, McGraw Hill Education	2015
3.	Kapoor, K.L.(2015),A Textbook of Physical Chemistry,Vol 5, 3rd Edition, McGraw Hill Education.	2015
4.	Laidler K.J. (2003), Chemical Kinetics, 3rd Edition,Pearson Education India.	2003
5.	Castellan, G. W. (2004), Physical Chemistry, 4th Edition, Narosa.	2004
Mode of Evaluation:	Internal Assessment / End Semester Exam	