

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI, HYDERABAD CAMPUS
INSTRUCTION DIVISION
FIRST SEMESTER 2016-17
Course Handout (Part – II)

Date: 01/08/2016

In addition to Part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding this course.

Course No. : CHEM F312
Course Title : Physical Chemistry IV
Instructor-in-charge : Dr. AMIT NAG
Instructors: Dr. G Ramakrishnan & Dr. Amit Nag

1. Scope and Objective of the course:

The first part of the course provides a comprehensive survey of the concepts, involved to study different kind of forces originated due to the interaction between molecules and its effect on the physical properties of matter like dipole moment, diffusion, viscosity etc. Introduction of surface chemistry *e.g.* formation of colloids, micelles etc. will also be discussed. The second part of the course includes investigations of rates of chemical reactions in different conditions, theories of reaction rates and interpretation from statistical thermodynamics.

2. Text Book:

T1. I. N. Levine, “Physical Chemistry”, 5th Edition, Tata McGraw-Hill, 2011.

3. Reference Book:

R1: P.W. Atkins & Julio de Paula, “Atkins’ Physical Chemistry”, Ninth edition (Oxford University Press, Oxford, 2010).

4. Course Plan:

LN	Topics	Learning Objectives	Chapter
1-3	Weak forces	Electric dipole moment, Polarization, Interaction between dipoles, Interaction between induced dipoles, Hydrogen bonding, Total attractive and repulsive interactions	T1: 14.15, 22.10 R1: 17.1 - 17.6, Lecture Notes
4-5	Surface Chemistry	Molecular interactions in gases, Liquid-vapour interface, Surface films, Thermodynamics of surface layers	T1: 13.1-13.4 R1: 17.7 – 17.10, Lecture Notes
6-7	Colloids, micelles, and reverse micellar structures	Classification, Preparation, Structure & stability of colloids, Micelle formation, Reverse micellar structures, Bilayers, Determination of size & shape	T1: 13.6 R1: 18.6 – 18.9(b), Lecture Notes
8-10	Transport processes	Kinetics, Viscosity, Diffusion, Sedimentation, electrical conductivity of solids and electrolyte solutions	T1: 16.1 – 16.7, Lecture Notes
11-13	Rates of chemical reactions and analysis of kinetic data of simple reactions	Definition of rate, derivation of concentration time relationship for simple reactions, Determination of rate law, Half-life of reactions, reactions approaching equilibrium	T1: 17.1 – 17.4
14	Chain reactions	Polymerization kinetics, chain polymerization reactions	T1: 17.13
15-16	Homogeneous catalysis	Details of enzyme catalysis, Michaelis-Menten equation	T1: 17.16 – 17.17
17-18	Adsorption of gases on	Extent of adsorption, Physisorption and	T1: 13.5

	solids	chemisorptions, Adsorption isotherms	
19-20	Heterogeneous catalysis	Extent of adsorption, rates of surface processes	T1: 17.18
21-23	Elementary reactions, Complex reactions	Elementary reactions, consecutive reactions, steady-state approximation, rate determining step, rate constants and equilibrium constants	T1: 17.5 – 17.6, 17.9
24	Effect of temperatures on reaction rates, rate law in non-ideal systems	To get an insight about the activation energy	T1: 17.8, 17.10
25-27	Theories of reaction rates	Theoretical description of reaction rates: CT and TST	T1: 23.1-23.2, 23.4-23.6
28-30	Rate laws and reaction mechanisms	Unimolecular reactions, bimolecular reactions, Lindemann-Hinshelwood mechanism	T1: 17.11 – 17.12
31-32	Fast reaction kinetics, reactions in solutions, diffusion controlled reactions	Techniques to study the reaction at extreme rate, reaction rates in solution and diffusion controlled reactions	T1: 17.14 – 17.15, Lecture Notes
33-39	Statistical Thermodynamics	Partition function, thermodynamic information from canonical partition function, molecular partition function, equilibrium constants	T1: 22.2 – 22.4, 22.6 – 22.8, Lecture Notes
40	Reactions in solution	Extending the gas phase theories to the solution phase	T1: 23.8
41-42	Molecular reaction Dynamics	Reaction trajectory	T1: 23.3, Lecture Notes

5. Evaluation Scheme:

Evaluation component	Duration	Weightage (%)	Date and Time	Remarks
Test I	1 hour	15	10/9, 10.00--11 AM	Closed Book
Test II	1 hour	15	22/10, 10.00--11 AM	Closed Book
Quiz*	-	10	Continuous	Closed Book
Lab components**		20	Will be announced by I/C	Open Book
Comprehensive Examination	3 hrs.	40	09/12 AN	Closed Book

Tutorials: The tutorial hour will be used for a quick review of the highlights of the materials covered in the lectures, clarification of doubts and problem solving.

* There will be a total of **4 surprise quizzes**.

** There will be few lab components which will be announced and scheduled by I/C during the course. There will be NO MAKEUP for the lab components.

6. Make-up Policy: Make up will be considered only for **genuine reasons**.

7. Chamber consultation hour: To be announced in the class.

8. Notices: All notices concerning the course will be displayed **only** on the **Chemistry Group** notice board.

Instructor-in-charge
CHEM F312