

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

1. Name of the Academic Unit: Chemistry

2. Subject Name: Thermodynamics and Kinetics L-T-P: 3-1-0 Credits: 4

3. Pre-requisites: Nil

4. Syllabus and reference books:

Syllabus:

Module 1: Principles of Thermodynamics:

- 1) First Law of Thermodynamics, Thermochemistry, Second Law of Thermodynamics and concept of Entropy, Helmholtz and Gibbs free energy, Equilibrium and spontaneity conditions for Closed Systems, Maxwell Relations
- 2) The Chemical Potential; Definition and concept of Open Systems; Application of concept of chemical potential to colligative properties
- 3) Thermodynamics of mixtures and solutions
- 4) Phase equilibrium of pure and mixed systems
- 5) Reaction equilibrium
- 6) Equilibrium electrochemistry
- 7) Acids, Bases, and Buffers

Module 2: Kinetics of Physical Processes

- 1) Transport in gases: Kinetic theory of gases; Effusion; Transport properties of ideal gases: diffusion, thermal conductivity and viscosity
- 2) Molecular motions in liquids: Diffusion, Electrolytic conduction, Mobility of ions

Module 3: Kinetics of Chemical Processes

- 1) Review of rate laws; Effect of temperature on reaction rates
- 2) Complex reactions: consecutive reactions, parallel reactions, reversible reactions, chain reactions, oscillatory reactions
- 3) Fast reactions in solution: The flow method, the relaxation method

Reference Books:

1. Atkins' Physical Chemistry, 10th Edition 2014, P.W. Atkins and J. de Paula, Oxford University Press
2. Physical Chemistry, 5th Edition 2002, I. N. Levine, Tata McGraw-Hill
3. Physical Chemistry, 3rd Edition 2015, Thomas Engel and Philip Reid, Pearson Education
4. Physical Chemistry, 4th Edition 2005, Robert J. Silbey, Robert A. Alberty and Moungi G. Bawendi, John Wiley & Sons, Inc.

5. Lecture-wise break-up:

Sl. No.	Topic	No. of lectures
1.	First Law of Thermodynamics, Thermochemistry, Second Law of Thermodynamics and concept of Entropy, Helmholtz and Gibbs free energy, Equilibrium and spontaneity conditions for Closed Systems, Maxwell Relations	10 hours
2.	The Chemical Potential; Definition and concept of Open Systems; Application of concept of chemical potential to colligative properties	4 hours
3.	Thermodynamics of mixtures and solutions	2 hours
4.	Phase equilibrium of pure and mixed systems	5 hours
5.	Reaction equilibrium	2 hours
6.	Equilibrium electrochemistry	4 hours
7.	Acids, Bases, and Buffers	2 hours
8.	Transport in gases: Kinetic theory of gases; Effusion; Transport properties of ideal gases: diffusion, thermal conductivity and viscosity	3 hours
9.	Molecular motions in liquids: Diffusion, Electrolytic conduction, Mobility of ions	3 hours
10.	Review of rate laws; Effect of temperature on reaction rates	2 hours
11.	Complex reactions: consecutive reactions, parallel reactions, reversible reactions, chain reactions, oscillatory reactions	2 hours
12.	Fast reactions in solution: The flow method, the relaxation method	1 hour
	Tutorials	12 hours
Total number of hours		52