Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2022-2023
Course Handout (Part - II)

29/08/2022

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : **CHEM F211**
Course Title : **PHYSICAL CHEMISTRY I**
Instructor-in-charge : **Prof. Durba Roy**
Co-Instructor : **Prof. Subit Kumar Saha**

Scope and Objective of the Course: The course is concerned with the basic understanding of physical chemistry for the students at undergraduate level. It includes the kinetic theory of gases, chemical thermodynamics and its applications to solutions, equilibrium and electrochemical systems. The course looks at the concept of energy and energy changes occurring in physical, chemical and biological systems. It thus belongs to all branches of science and its knowledge equips the scientists to predict the existence of a state or the probability or feasibility of a process to occur at a given temperature and pressure. The course will include a brief introduction to principle and the methods of thermodynamics, and its applications in various disciplines.

2. Text Book: 'Physical Chemistry'**,** Ira N. Levine, Fifth Edition, Special Indian Edition (Tata McGraw-Hill, 2002).

3. Reference Books:

(1) 'Physical Chemistry', G.M. Barrow, Fifth Edition, Special Indian Edition (Tata McGraw-Hill, 2007).

(2) 'The Elements of Physical Chemistry', P.W. Atkins & Julio de Paula, Fifth edition (Oxford University Press, 2009).

4. Course Plan:

Lecture Nos.	**Learning Objectives**	**Topics to be Covered**	**Chapter in the Text Book**	**Learning Outcome**
1-3	First Law of Thermodynamics	First Law, p-V work, internal energy, enthalpy, heat capacities, Joule and Joule-Thompson experiments, estimation of Ist Law quantities	2.2-2.9	Compare the relationship between work and energy (heat) for different processes
4-6	Second Law of Thermodynamics	Second Law, Heat Engines, Entropy, Thermodynamic Temperature Scale,	3.1- 3.6	Develop certain criteria to determine wheather a given process is spontaneous

7-9	Material Equilibrium	Concepts of Gibbs energy, chemical potential, Phase and Reaction equilibrium,	4.1, 4.4 - 4.5, 4.7-4.10	Develop the condition for equilibrium
10-11	Standard States	Standard states and enthalpies, Temp dependence of reaction heats	5.1-5.5	How to use experimental data to estimate equilibrium condition?
12-13	Third Law of Thermodynamics	Entropy and third law, estimation of thermodynamic properties	5.7-5.8, 5.10	What is absolute entropy?
14-16	Thermodynamics of Ideal Gases and Phase Equilibrium	Ideal-gas reaction equilibrium, temperature dependence, One component phase equilibrium, Clapeyron equation	6.1-6.4, 7.2-7.3	Know how to calculate the equilibrium composition for ideal gas reactions from the initial composition, the temperature and pressure
17-20	Kinetic theory of Gases	Molecular theory, perfect gas, Maxwell and Boltzmann distribution, collisions, heat capacities	15.1-15.6, 15.9-15.10	Apply molecular picture to measure macroscopic properties of gases
21-22	Thermodynamics of Real Gases	Real gases, critical states, law of corresponding states	8.1-8.4, 8.6, 8.7	Different real-gas equations of state
23-25	Solutions	Partial molar quantities, ideal solution	9.1–9.3, 9.5-9.7	Know different partial molar quantities and thermodynamic definition of ideal solution
26-27	Non-ideal Solutions	Activity and activity coefficients, Debye Huckel Theory, Standard State Properties	10.1, 10.8-10.11	Learn and apply the parameters which account for the deviation from ideality
28-30	Reaction Equilibrium in non ideal systems	The equilibrium constant, Weak acids-buffers, Temp and pressure dependence of K	11.1, 11.3, 11.7	Know how to compute equilibrium compositions in nonideal systems
31-35	Multi Component Phase Equilibrium	Colligative properties, two component systems, solubility	12.1-12.10	Know how the change in chemical potential affects the colligative properties and two component phase diagram
36-40	Electrochemical Systems	Electrochemical systems and their thermodynamics, Galvanic cells, standard electrode potentials, concentration cells, liquid junction, ion-selective electrodes, membrane	14.1-14.9, 14.11-14.14	Learn the thermodynamics of the Galvanic cells and their practical use to supply electric power

		equilibrium, double layer		

5. Evaluation Scheme:

Evaluation component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid Semester Test	1.5 hrs.	35	31/10 9.00 - 10.30AM	Closed Book
Quizzes & Assignments*	-	25	Continuous	Open Book
Comprehensive Examination	3 hrs.	40	17/12 FN	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.

* **No makeup will be allowed for this component**.

6. **Chamber Consultation Hours**: To be announced in class.

7. **Notices**: Notices, if any, concerning the course will be displayed on CMS, MS Teams Channel and Chemistry Notice board.

8. **Make-up-policy**: Make up would be considered only for genuine reasons.

9. **Academic Honesty and Integrity Policy**: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
CHEM F211