Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2020-2021

Course Handout Part II

Date: 17-08-2020

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

Course No. : CHEM F211
Course Title : Physical Chemistry I
Instructor-in-Charge : Subit Kumar Saha

Scope and Objective of the Course: This is the first of the four Physical Chemistry courses designed for M.Sc. Chemistry Programme. The laws of thermodynamics are discussed, and representative applications in phase equilibrium, reaction equilibrium, and electrochemistry presented. Reaction equilibria in the systems with ideal gases and non-ideal gases, and thermodynamics of fully ideal, ideally dilute and non-ideal solutions described.

Textbooks:

1. Levine Ira N., *Physical Chemistry*, 6th ed., Tata McGraw-Hill, New Delhi, 2009.

Reference books

R1. Donald A. McQuarrie and John D. Simon, *Molecular Thermodynamics*, Viva Book Pvt. Ltd., New Delhi, 2004.
R2. K. G. Denbigh, *Principles of Chemical Equilibrium*, 4th Ed. Oxford University Press, New Delhi, 1981,
R3. G. N. Lewis and M. T. Randall (Revised by K. S. Pitzer and L. Brewer), *Thermodynamics*, McGraw-Hill, N.Y., 1961.

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-2	State Variables, equilibrium States, Thermal Equilibrium and Temperature, Equation of State	Thermodynamic Systems, Zeroth Law	1.2, 1.3, 1.5 (Self- study), 1.6, 1.7
3-4	Work, Internal energy, and Heat Transfer, Exact and Inexact differentials, Enthalpy and Heat Capacities	First Law	2.2 to 2.11
5-7	Natural & Reversible Processes,	Second Law of	3.1 to 3.7

	Heat Engines, Entropy, Thermodynamic Temperature, Spontaneity & Equilibrium in Isolated Systems	Thermodynamics	
8-9	Spontaneity and Equilibrium in Non-isolated Systems	Free Energy	4.1 to 4.4
10-11	Calculation of changes in Thermodynamic Properties	Thermodynamic Relationships	4.5, 4.6
12	Absolute Entropy, Low Temperatures	Third Law	5.7, 5.11
13-14	Open Systems, Chemical Potential and Material Transfer, Gibbs-Duhem Equation	Partial Molar Properties	9.1 to 9.4, 4.7
15-17	Perfect Gases & Gas Mixtures, Real Gas, Equations of State, Condensation, fugacity	Thermodynamics of Gases	2.7, 2.8, 6.1, 8.1 to 8.8, 10.10
18-20	Nature of Chemical Equilibrium, Equilibrium Constant K, Thermochemistry, Temperature dependence of K, Equilibrium Calculations	Reaction Equilibrium	4.8, 6.2 to 6.4, 6.6, 5.1 to 5.5, 5.8, 5.9, 11.4, 11.5
21-23	Gibbs Phase Rule, Phase Diagram, Critical Phenomena	One-Component Phase Equilibrium	4.7, 7.1 to 7.4
24-27	Fully ideal, and ideally dilute solutions. Non-ideal solutions: Activity and Activity coefficients, Solid-Liquid and Liquid-Vapor Equilibrium, Reaction Equilibrium	Solutions of non-electrolytes	9.5 to 9.8, 10.1 to 10.4, 12.1 to 12.4, 11.4, 11.7
28-29	Ionic activities, ionic interactions, Debye-Hückel Theory	Electrolyte Solutions	10.5-10.7, 10.10
30-31	Reversible Electrodes and galvanic Cells, Cell Potential and Reaction Gibbs Energy, Nernst Equation, Applications	Electrochemical Systems	13.4 to 13.10
32-33	Kinetic - molecular theory of gases; perfect gas; pressure and temperature; Maxwell distribution; collisions, effusion, mean free path; Boltzmann distribution law and heat capacities;	Kinetic theory of gases	14.1 to 14.5, 14.6-14.7(Self-study), 14.9,14.10
34-36	Solubility Product, Weak Acids, Buffers, Coupled Reactions.	Reaction Equilibrium in non-ideal systems	11.1, 11.2-11.3(Self-study), 11.4,11.5
37-39	Colligative Properties; Two and Three component Systems; Solubility	Multi component Phase Equilibrium	12.5 to 12.8

40-42	Ion selective electrodes, Double layer, dipole moments and polarizations, biological applications; Overvoltage as a concept to introduce importance of kinetic measurements.	Electrochemical Applications	13.11 to 13.15 with some references to Ch.15

Evaluation Scheme:

Component	Duration (Minutes)	Weightage (%)	Date & Time	Nature of Component
Test I	30	15	September 10 – September 20 (During scheduled class hour)	Open Book
Test II	30	15	October 09 –October 20 (During scheduled class hour)	Open Book
Test III	30	15	November 10 – November 20 (During scheduled class hour)	Open Book
Quiz/Assignment/ Viva[#]	-	20	Continuous	Open Book
Comprehensive Examination	120	35	TBA	Open Book

The tutorial hour will be used for a quick review of the highlights of the material covered in the lectures, clarification of doubts and problem solving, and conducting any evaluation component. Quiz/assigned/viva will be conducted periodically. Students are expected to be regular in attending classes, and participate in the discussion.

Chamber Consultation Hour: Every Tuesday except holiday between 5:00 PM to 6:00 PM.

Notices: All notices would be displayed in CMS.

Make-up Policy: See Part I for details.

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