Birla Institute of Technology & Science, Pilani, K K Birla Goa Campus
Instruction Division, First Semester 2024-2025
Course Handout (Part-II)

Date: 02-08-2024

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

1. **Course No.**: CHEM F111
2. **Course Title**: GENERAL CHEMISTRY
3. **Instructor-in-Charge**: Prof. Kiran Vankayala, (kiranv@goa.bits-pilani.ac.in)
4. **Lecture Instructors**: Prof. Raghu Nath Behera, (rbehera@goa.bits-pilani.ac.in)
   Prof. Bhavana P., (pbhavana@goa.bits-pilani.ac.in)
   Prof. Subhasish Roy, (subhasishr@goa.bits-pilani.ac.in)
   Prof. Jayadevan, K. P., (jayadev@goa.bits-pilani.ac.in)
5. **Tutorial Instructors**: Prof. Tincy Lis Thomas, (tincy@goa.bits-pilani.ac.in)
   Prof. Rabi Narayan Panda, (rnp@goa.bits-pilani.ac.in)
   Prof. Subhadeep Benerjee, (subhadeepb@goa.bits-pilani.ac.in)
   Prof. Kiran Vankayala, (kiranv@goa.bits-pilani.ac.in)
   Prof. Sudipta Chatterjee, (sudiptac@goa.bits-pilani.ac.in)
   Prof. Woormileela Sinha, (woormis@goa.bits-pilani.ac.in)
   Prof. Uttara Basu, (uttarab@goa.bits-pilani.ac.in)
   Prof. Saurav Bhattacharya, (sauravb@goa.bits-pilani.ac.in)
   Prof. Sandip Kumar Nandi, (sandipn@goa.bits-pilani.ac.in)
6. **Scope and Objective of the Course**: The course covers topics from physical chemistry such as basics of quantum theory, electronic structure of atoms and molecules, spectroscopy, thermodynamics, chemical equilibrium and chemical kinetics. Stereochemistry and reactivity of organic compounds are included as topics from organic chemistry along with reaction mechanisms. A comprehensive survey of the concepts involved in the study of the transition metal-based coordination complexes, valence bond theory (VBT) and crystal field theory (CFT) for inorganic complexes are included as topics from inorganic chemistry.
7. **Text Books:**

   T1: J. D. Lee, Concise Inorganic Chemistry, 5th Edition, Blackwell Science, Oxford, 1996.

   T2: P. Atkins & J. De Paula, Elements of Physical Chemistry, International Edition, Oxford University Press, 2017.

   T3: T. W. Graham Solomons, Craig B. Fryhle and Snyder Scott A., Organic Chemistry, Global Edition, John Wiley & Sons, Inc. New York, 2011.

8. **Reference Books:**

   R1: R T Morrison, R N Boyd & S K Bhattacharjee, Organic Chemistry, 7th Ed, Pearson Education in South Asia, 2010.

   R2: J. E. Huheey, E. A. Keiter, R. L. Keiter & O. K. Medhi, Inorganic Chemistry, Principles of Structure & Reactivity, 4th Ed, Pearson Education in South Asia, 2011.

9. Course Plan:

Lec. No.	Topics to be covered	Learning Objectives	Reference
01-04	Quantum Theory	Wave function, Schrodinger equation, Uncertainty principle and simple applications.	T2: 7A-C,7E and lecture notes
05-08	Atomic Structure and Spectra	Hydrogenic Atom: Energy Levels and wavefunctions, Orbitals, Spectral Transitions, Many-electron Atoms: Pauli Principle, Orbital Approximation and Aufbau Principle.	T2: 8A, 8D.1 (Selection rule & not Grotrian Diagram), 8B-8C (SS) and lecture notes
08-11	Chemical Bonding: Valence Bond and Molecular Orbital Theories	VB Theory: Electron Pair Bond, Hybridization, Resonance. MO Theory: LCAO, Bonding and Antibonding Orbitals, Diatomic Molecules.	T2: 9A-9C and lecture notes
12-14	Vibrational and Electronic spectroscopy	General Features Vibrational Energy Levels and Spectra and applications; Electronic Spectra: Franck-Condon Principle and Types of Transitions.	T2: 13A.1-2, 13C.1-C.3, 13C.5,13D.1-3 and lecture notes
15-17	Some Concepts in Inorganic Chemistry & Introduction to Coordination compounds	Double salts and coordination compounds, Werner's work, Identification of structure by isomer counting and Effective Atomic No. concept.	T1: pp194-201 and lecture notes
18-19	VB theory and Crystal field theory for octahedral complexes	Explanation for the stability of complexes according to crystal field theory.	T1: pp202-214 and lecture notes
20-21	Jahn-Teller distortions; Square planar and Tetrahedral complexes	How do geometrical distortions stabilize the system? Stability in other Geometries.	T1: pp214-222 and lecture notes
22	Chelates & Isomerism	Different types of ligands and stabilization due to entropy factors and electron delocalization in the rings.	T1: pp222-224, 307, 351-352, 389, 793, 807, 230-236 (SS) and lecture notes
23-25	Stereochemistry	Isomerism, chirality, origin of optical activity, stereochemistry of cyclic compounds and resolution.	T3: 5.1-5.13, 5.14-5.18 and lecture notes
26-27	Conformations	Rotation around sigma bonds, conformational analysis of butane and cyclohexanes.	T3: 4.8-4.9, 4.10 (SS), 4.11-4.13 and lecture notes
28-29	Substitution reactions	Nucleophilic substitution reactions (both S_N1 and S_N2) of alkyl halides.	T3: 6.2-6.14 and lecture notes
30-32	Elimination reactions	Elimination reaction of alkyl halides; Hoffmann and Cope Elimination.	T3:7.5-7.11, 20.12 and lecture notes
33-34	Addition reactions	Addition reactions to >C=C< bond.	T3: 8.1 (SS), 8.2-8.16 and lecture notes

35-37	Thermodynamics: The First, second and third laws	Thermodynamic Systems, State Functions, Thermal Equilibrium and Temperature, Work, Internal Energy and Heat Transfer, Heat Capacity, Entropy and thermochemistry.	T2: 2A-2F (SS) 3A-3C and lecture notes
38-39	Spontaneity and equilibrium	Applications of entropy, Gibbs energy in chemical reactions and Equilibrium constant.	T2: 3D, 4A, 5A, 5B-5C (SS) and lecture notes
40-42	Chemical Kinetics: Experimental Methods, Reaction Rates, Temperature Dependence	Rate Laws, Order, Rate Constants, Arrhenius Equation, Rate determining step and Steady-state approximation.	T2: 6A-6C, 6D.1-6D.2, 6F.1-6F.2, 6F.5-6F.6 and lecture notes

*SS: Self-Study

10. Evaluation Scheme[$]:

Component	Duration (min)	Weightage (%)	Marks	Date, Day &Time	Remarks
Quiz-I	30	15	45	14-09-2024 (Saturday)	Open Book[*]
Mid-Semester Examination	90	30	90	03-10-2024 (Thursday)	Closed Book[*]
Quiz-II	30	15	45	12-11-2024 (Saturday)	Open Book[*]
Comprehensive Examination	180	40	120	03-12-2024 (Tuesday)	Closed Book[*]

[*] *Refer to the notices to be displayed in QuantaAWS course page prior to the examination/Test/Quiz*
[$] *The revised handout will be uploaded later, in case of any minor modifications.*

11. Chamber Consultation Hours: Will be announced in QuantaAWS course page.

12. Make-up Policy: Make-up will be granted only on genuine reason on case-to-case basis.

13. Notices & Announcements: Notices concerning the course will be displayed on the https://quantaaws.bits-goa.ac.in/login/index.php

Instructor-in-Charge
CHEM F111