



INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH, MOHALI

FIRST SEMESTER 2016-2017

CHEMISTRY OF ELEMENTS AND CHEMICAL TRANSFORMATIONS

Course Handout

Date: 01.08.2016

Course No. : CHM101
Course Title : Chemistry of Elements and Chemical Transformations
Instructor : Dr. Angshuman Roy Choudhury
Tutors : Dr. Sanjay Singh, Dr. Santanu Kumar Pal and Dr. Ujjal Kam Gautam

1. **Course Description:** This course is aimed at topics on basics of organic chemistry and inorganic chemistry.

2. **Scope & Objective of the Course:** The course is divided into two parts. In the first part, basics of organic chemistry including the basics of stereochemistry of organic molecules (conformations and configurations, isomerism, chirality, atropisomerism), substitution and elimination reactions and reaction mechanism, factors influencing reaction mechanisms etc. will be covered. In the second part, basics of inorganic chemistry highlighting the periodic table, periodic properties of elements, main group elements and their compounds, s-block and p-block elements and their properties and reactions, halides and their properties, elementary transition metal chemistry, Valence bond and crystal field theories and their applications, electronic transitions and origin of color in transition metal complexes will be discussed.

3. **Text Books: Organic Chemistry:** (1) R. T. Morrison and R. N. Boyd, *Organic Chemistry*, 6th Indian Ed., Pearson Education, New Delhi, 2007; (2) P. Sykes, *A Guidebook to Mechanisms, in Organic Chemistry*, 6th Indian Ed., Pearson Publication, New Delhi, 2006.

Inorganic Chemistry: (1) J. D. Lee, *Concise Inorganic Chemistry*, 5th Indian Ed. Blackwell Science Limited, Oxford, 1996; (2) J. E. Huheey, E. A. Keiter and R. L. Keiter, *Inorganic Chemistry Principles of Structure and Reactivity*, 4th Indian Ed. Pearson Education, India, 2007.

4. **Reference Books: Organic Chemistry:** (1) T. W. Graham Solomons and C. B. Fryhle, *Organic Chemistry*, 8th Ed. John Wiley & Sons, Inc. New York, 2004; (b) D. Nasipuri, *Stereochemistry of Organic Compounds Principles and Applications*, 2nd Ed. New Age International (P) Ltd Publishers, New Delhi, 1996.

Inorganic Chemistry: (1) F. A. Cotton, G. Wilkinson and P. A. Gaus, *Basics of Inorganic Chemistry*, 3rd Wiley Indian Ed. John Wiley & Sons Inc. Singapore, 1995; (2) A. G. Sharp, *Inorganic Chemistry*, 3rd Ed. Addison Wesley Longman Harlow, England, 1992; (c) P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller, F.A. Armstrong, *Shriver and Atkins' Inorganic Chemistry*, 5th Edition, Oxford University Press, England, 2010.

3. Course Plan:

Lecture Nos.	Learning Objectives	Topics to be Covered
1-2	Introduction and IUPAC nomenclature	Introduction to the course, rule of IUPAC Nomenclature, naming of compounds with different functional groups, multiple functional groups, aromatic compounds, allenes and spiro compounds.
3-7	Stereochemistry	Isomerism, isomers and conformers, conformations of alkanes and cyclo-alkanes, chirality, Neumann projection, Shaw-horse projection, Fisher projection, enantiomers, diastereomers, homomers and meso-compounds, symmetry in organic molecules, point groups of simple organic molecules.
8-10	Substitution Reactions	Nucleophilic substitution reactions and their reaction mechanisms (S_N1 and S_N2), factors (nature of substrate, role of solvent and temperature etc) influencing these reactions, carbocations, factors influencing the stability of carbocations.
11-12	Elimination reactions	Elimination reactions and their mechanisms ($E1$ and $E2$), factors (nature of substrate, role of solvent and temperature etc) influencing these reactions, Hoffman and Cope elimination reactions.

13	Substitution reaction vs Elimination reaction	S_N1 vs E1 and S_N2 vs E2
14-16	Other important reactions	Addition reactions to C=C and C≡C, Diels-Alder reaction, Aldol condensation reaction, Friedel-Crafts reactions, Various oxidation and reduction reactions.
17-18	Periodic table and periodic properties	Introduction to Periodic table, electronic configuration, variation of size, cation radius, electron affinity, ionization potential along the period, diagonal relationship, properties.
19-22	s- and p-Block elements	Properties of s- and p-block elements and their compounds, properties of halogens and halides, oxides, halides, hydrides of s-block and p-block elements.
23-24		Oxo-acids, silicates, silicones, borazine and phosphazenes, polyhalides, pseudo-halogens, inter-halogen compounds and halogen cations, diborane.
25-28	Transition elements and their chemistry	First transition series, their electronic configuration, Valence bond and Crystal Field theories, octahedral, square planar, linear and tetrahedral complexes, isomerism in transition metal complexes, Jahn-Teller effect, chelate effect and its application,
29-30	Spectroscopic and magnetic properties of transition metal complexes	Various electronic transitions (d-d, MLCT, LMCT and intra ligand) in transition metal complexes, magnetism in transition metal complexes.
31	Q and A session on the course	

4. Evaluation Scheme:

EC NO.	Evaluation Component	Duration	Marks	Date, Time, Venue	Nature of Component
1.	Mid-sem I	1 hr.	40	Thursday, 8-9-16 14:30-15:30	Closed Book
2.	Mid-sem II	1 hr.	40	Wednesday, 5-10-16 14:30-15:30	Closed Book
3.	Surprise test/quiz (4) in tutorials	15 minutes	10 x 4	Tutorial Hour	Closed Book
4.	End-sem Exam.	3 hrs	100	Wednesday, 30-11-16 9:00-12:00	Closed Book

5. **Office Consultation hours:** Tuesday, 9:00-10:30 hrs in 4F5.

6. **Make-up Policy:** Make-up will be granted following institute rules.

7. **Notices:** Relevant notices regarding the course will be displayed on Notice Board in LHC.

Instructor
CHM101