Course: Discipline Specific Core 6

Semester	**3**
Paper Number	**HCHCR3062T (60 MARKS) & HCHCR3062P (40 MARKS)**
Paper Title	**CORE COURSE 6: INORGANIC CHEMISTRY**
No. of Credits	**Theory-04, Practicals-02**
Theory/Composite	Composite
No. of periods assigned	Th: 4 Pr: 3
Name of Faculty member(s)	Dr. Sanjib Ganguly Dr. Rahul Sharma
Course description/objective	***Theory:*** ***1. To understand the idea of lattice and to be able to find out the lattice energy by several methods.*** ***2. To develop the basic idea of defects in lattices and the principles of solubility.*** ***3. To be acquainted with the several theories of bonding in accordance with the Valence Bond Theory*** ***4. To have a grasp of the MOT of simple hetero and homo-nuclear diatomic molecules as well as some triatomics (non-mathematical approach); understanding metallic bonding in a qualitative way*** ***5. To be able to comprehend the application of weak forces in Chemistry*** ***6. To develop some idea about Nuclear Binding energy and some theories of nuclear stability.*** ***7. To understand certain nuclear reaction as well as the application of radio-isotopes.*** ***Practical:*** ***1. To comprehend the principle of iodometry/ iodimetry and develop the skills to apply them in analysis*** ***2. To appreciate the underlying principles of complexometric titration and develop the skills to apply them in analysis.*** ***3. To be able to estimate metals from their ores.***
Syllabus	Annexure Core Course: 6
Texts	
Reading/Reference Lists	**Theory:** 1.Huheey, J. E.; Keiter, E.A. & Keiter, R.L. *Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed.,* Harper Collins 1993, Pearson, 2006. 2. Douglas, B.E. and McDaniel, D.H. *Concepts & Models of Inorganic Chemistry* Oxford, 1970. 3. Mingos, D.M.P., *Essential trends in inorganic chemistry*. Oxford University Press (1998). 4. Purecell, K.F. and Kotz, J.C., *An Introduction to Inorganic Chemistry*, Saunders: Philadelphia, 1980. 5. Gillespie, R. J. and Hargittai, I., The VSEPR Model of Molecular Geometry, Prentice Hall (1992). **Practical:** 1. Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis* 6th Ed., Pearson, 2009.

Evaluation	**Theory: 60 marks**	**Practical: 40 marks** *(Continuous Assessment)*
	CIA: 10 End-Sem: 50	Internal Assessment Exams: 30 Viva (End Sem): 8 Attendance: 2
Paper Structure for the End Sem **Theory Exam** (50 marks)	6 (SIX) Questions (each of 10 marks) will be set and the students will have to answer any 5 (FIVE). Each of the Questions (10 marks) will consist of 2 or 3 parts (of 2/ 3/ 4/ 5)	

Annexure Core Course (CC): 6
(Credits: Theory-04, Practicals-02)

<u>CC: 6 (Theory) 52 Lectures</u>

Module 1: Ionic and Covalent Bonding (VBT) (32 Lectures)

(i) *Ionic bond:* General characteristics, types of ions, size effects, radius ratio rule and its application and limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy. Defects in solids (elemementary idea). Solubility energetics of dissolution process.

(ii) *Covalent bond:* Polarizing power and polarizability, ionic potential, Fazan's rules. Lewis structures, formal charge. Valence Bond Theory. The hydrogen molecule (Heitler-London approach), directional character of covalent bonds, hybridizations, equivalent and non-equivalent hybrid orbitals, Bent's rule, Dipole moments, VSEPR theory, shapes of molecules and ions containing lone pairs and bond pairs (examples from main groups chemistry) and multiple bonding (σ and π bond approach).

(iii) Molecular orbital concept of bonding (The approximations of the theory, Linear combination of atomic orbitals (LCAO)) (elementary pictorial approach): sigma and pi-bonds and delta interaction, multiple bonding. Orbital designations: *gerade*, *ungerade,* HOMO, LUMO. Orbital mixing,. MO diagrams of H_2, Li_2, Be_2, B_2, C_2, N_2, O_2, F_2, and their ions wherever possible; Heteronuclear molecular orbitals: CO, NO, NO^+, CN^-, HF, BeH_2, CO_2 and H_2O. Bond properties: bond orders, bond lengths.

Module 2: Metallic Bonding, Weak Forces & Radioactivity (20 Lectures)

(i) *Metallic Bond:* Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.

(ii) *Weak Chemical Forces:* van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Intermolecular forces: Hydrogen bonding (theories of hydrogen bonding, valence bond treatment), receptor-guest interactions, Halogen bonds. Effects of chemical force, melting and boiling points.

(iii) Nuclear stability and nuclear binding energy. Nuclear forces: meson exchange theory. Nuclear models (elementary idea): Concept of nuclear quantum number, magic numbers. Nuclear Reactions: Artificial radioactivity, transmutation of elements, fission, fusion and spallation. Nuclear energy and power generation. Separation and uses of isotopes. Radio chemical methods: principles of determination of age of rocks and minerals, radio carbon dating, hazards of radiation and safety measures.

CC: 6 (Practical) 42 Lectures

1. Estimation of Cu in brass
2. Estimation of Vitamin C
3. Estimation of Calcium in milk (complexometry)
4. Estimation of available chlorine in bleaching powder.
5. Estimation of Ca and Mg in a mixture (complexometry) .
6. Estimation of Cr and Mn in Steel
7. Estimation of Zn and Cu from a mixture of Zn(II) and Cu(II) by complexometry.
8. Estimation of formaldehyde.
9. Estimation of hardness of water (complexometry)