

Syllabus (CBCS) For F.Y.B.Sc. Chemistry

w. e. from June 2022

Name of the Programme	:	B.Sc. Chemistry
Programme Code	:	USCH
Class	:	F.Y.B.Sc.
Semester	:	II
Course Name	:	Physical and Inorganic Chemistry
Course Code	:	USCH121
No. of Credits	:	02
No. of Lecture	:	36

A. Learning Objective:

1. To provide the details concepts involved in solid state and to understand the geometrical parameters.
2. To introduce basic concepts in atomic structure: Bohr model, energy level diagrams, hydrogen spectra, basic of quantum chemistry.
3. To adequate the students with basic concepts in energetics in terms of Thermochemistry, the use of thermodynamic state functions and thermochemical calculations.
4. To learn basic principle and concepts in chemical bonding and also to learn theories of overlapping of atomic orbitals, types of hybridizations involving s, p and d orbitals.

B. Learning Outcome:

1. Students should able to get geometrical information of crystal and would able to determine the geometrical parameters such as planar distances, density, etc.
2. This course makes understanding of assumptions of Bohr model, atomic spectra, Schrödinger equation for hydrogen atom and related mathematical calculations. Also make understanding of quantum mechanics and its applications.

3. Students should be able to know elementary thermochemistry and state functions used in thermochemical calculations, such as calculations of enthalpy, bond energy, bond dissociation energy, resonance energy
4. Student should be able to understand different types of bonding in a molecule and basic principles, concepts of overlapping of atomic orbitals.

Section I: Physical Chemistry

Unit I. Solid State (09 L)

Definition of space lattice, unit cell;

Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices (iii) Law of symmetry, Symmetry elements in crystals.

Fundamental crystal systems, Characteristics of simple cubic, face-centered cubic and body centered cubic systems, Inter-planar distances in cubic crystals,

X-ray diffraction by crystals, Derivation of Bragg equation, Determination of crystal structure of NaCl, Numerical

Unit II. Atomic structure: (08 L)

Historical perspectives of the atomic structure; Bohr's theory, Derivation of atomic radius and energy, energy level diagram of hydrogen atom and limitations of Bohr's theory, atomic spectrum of hydrogen atom

Origin of Quantum Mechanics: Failure of Classical mechanics- black body radiation, photoelectric effect, electron diffraction,

Quantization of energy, de Broglie's hypothesis, Heisenberg's uncertainty principle, Numerical

Unit III. Chemical Energetics (07 L)

Review of thermodynamics and the first laws of thermodynamics, Definitions of thermochemistry. Concept of standard state and standard enthalpies of formation, integral and differential enthalpies of solution and dilution, Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, Variation of enthalpy of a reaction with temperature – Kirchhoff's equation, Numerical

Section II: Inorganic Chemistry

Unit IV. Chemical Bonding and Structure (4 L)

Recapitulation of bonds: Ionic, covalent, coordinate and metallic.

Types of overlaps: s-s, s-p, p-p, p-d, d-d with examples, formation of sigma and pi bond.

Theories of bonding: Valence bond theory, Heitler –London theory, Pauling Slater theory.

Unit V. Concept of hybridization (8 L)

Definition and need of hybridization, steps involved in hybridization, explanation of covalency of atom in the molecules based on hybridization, types of hybridization involving in s, p and d orbital.

References:

1. Physical Chemistry, P. W. Atkins, ELBS, 5th Edition.
2. Principles of Physical Chemistry, Maron and Prutton, 4th Edition.
3. Physical Chemistry, G. M. Barrow 4th Edition.
4. Quantum Chemistry, I. Levine, 5th Edition.
5. Essentials of Physical Chemistry, Bhal and Tuli,
6. Principles of Physical Chemistry, Puri, Sharma and Phathania
7. Mathematical Preparation of Physical Chemistry, F. Daniel, McGraw Hill.
8. Concise Inorganic Chemistry, J. D. Lee, 5th Edition
9. Concept and Models of Inorganic Chemistry, Douglas and Daniel, 3rd Edition
10. Inorganic Chemistry, James Hughey

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Name of the Programme	:	B.Sc. Chemistry
Programme Code	:	USCH
Class	:	F.Y.B.Sc.
Semester	:	II
Course Name	:	Organic and Inorganic Chemistry
Course Code	:	USCH122
No. of Credits	:	02
No. of Lecture	:	36

A. Learning Objective:

1. To understand concept of isomerism, types of isomers and their stereochemistry.
2. To find R/S configuration in compounds containing one Chiral centers.
3. To use different reagents in organic synthesis.
4. To know silent features of periodic table with reference to P-block elements (symbols electronic configuration, trends and properties). Structures of compounds and applications of P block elements and inter halogen compounds.

B. Learning Outcome:

1. This course makes understanding of concept of isomerism, types of isomers and their stereochemistry and R/S configuration in compounds containing two Chiral centers.
2. Students are able to use different reagents in organic synthesis.
3. Students should know details about P- block elements.

SECTION I: ORGANIC CHEMISTRY

Unit I. Stereochemistry

(12 L)

Concept of isomerism, types of isomers, representation of organic molecules (Projection formulae), Conformational isomerism in alkanes (Ethane, propane and n-butane) with energy

profile diagrams, Geometrical isomerism -definition, conditions for geometrical isomers, physical and chemical properties, E/Z nomenclature of geometrical isomers.

Optical isomers, chirality, optical isomerism with one asymmetric carbon atom, specific rotation, enantiomerism, R/S nomenclature, R/S system nomenclature with wedge and Fischer representation of two chiral centres. Racemic mixture, meso compound and diastereomers.

Ref. 1, 2, 3.

Unit II. Reagents in Organic Synthesis (12 L)

Reducing agents: Catalyst (Ni/Pd/Pt) and H₂, Birch reduction, NaBH₄, LiAlH₄ and Sn/HCl,

Oxidising agents: KMnO₄, K₂Cr₂O₇, Jones reagent, PCC, per acids and OsO₄.

Ref. 1 & 3

SECTION II: INORGANIC CHEMISTRY

Unit III. Chemistry of P-Block Elements (12 L)

Position of elements in the periodic table, electronic configuration of elements, trends in properties like: atomic size, ionization potential, electro negativity, electron affinity, reactivity, oxidation state.

Structure and Properties of - 1) Borates and Halides of Aluminium 2) Allotropes of Carbon 3)

Oxyacids of Phosphorous, Sulphur and Chlorine 4) Interhalogen compounds

References:

1. Organic Chemistry-. Morrison and Boyd, 6th edition, prentice hall, 2001.
2. Stereochemistry of carbon compounds - E. L. Eliel
3. Reactions, rearrangements and reagents – S N Sanyal
4. Inorganic Chemistry-James Hughey
5. General Chemistry - Raymond Chang
6. Concise Inorganic Chemistry-J.D. Lee, 5th Edition-Relevant pages.
7. Concept & model of Inorganic Chemistry-Douglas Mc Daniels, 3rd edition.

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Name of the Programme	:	B.Sc. Chemistry
Programme Code	:	USCH
Class	:	F.Y.B.Sc.
Semester	:	II
Course Name	:	Chemistry Practical
Course Code	:	USCH123
No. of Credits	:	02
No. of Practicals	:	12

A. Learning Objective:

1. To adequate the students with graph of various functions.
2. To learn basic of chemistry practical from all the discipline of chemistry.

B. Learning Outcome:

1. Students will be able to apply mathematical knowledge in graphical representation of experimental data.
2. Basic experiments in all discipline of chemistry gives understanding of application.

I : Physical Chemistry (Minimum 4 experiments)

1. Sketch the polar plot of Sand P orbital.
2. Assign the lattice structure of NaCl crystal by given data .
3. Determination the heat of solution of KNO_3 / NH_4Cl .
4. Determination of heat of dissolution of NaCl /KCl.
5. Determination of heat of neutralization of strong base and strong acid .
6. Determination of enthalpy of hydration of copper sulphate.

II : Inorganic Chemistry (Minimum 4 experiments)

1. Inorganic Qualitative Analysis (**Three** water soluble mixtures without borate and phosphates)
2. Estimation of water of crystallization in Mohr's salt by titrating it with KMnO_4 .

III. Organic Chemistry (Minimum 4 experiments)

1. Determine amount of aspirin in APC tablet volumetrically.
2. Technique: -Thin layer chromatography.
3. Organic qualitative analysis of single liquid compound
(Type, Preliminary test and Physical constant).
4. Determination of elements and functional groups of solid compounds.
5. Determination of elements and functional groups of liquid compounds.

References:

1. Senior practical Physical chemistry, B. D Khosla and V.S .Garg .
2. Textbook of practical Inorganic Chemistry, A.I. Vogel.
3. Textbook of practical Organic Chemistry, A.I. Vogel.