

**COURSE STRUCTURE WITH CREDIT WEIGHTAGE OF CHEMISTRY FOR BACHELORS IN SCIENCE (GENERAL) 2020 AND ONWARDS:**

SEM	COURSE CODE	COURSE TITLE	COURSE TYPE	CREDIT WEIGHTAGE	
				THEORY	PRACTICAL
I	CH120C	CHEMISTRY	DSC-1	4	2
II	CH220C	CHEMISTRY	DSC-2	4	2
III	CH320C	CHEMISTRY	DSC-3	4	2
IV	CH420C	CHEMISTRY	DSC-4	4	2
V	CH520DA	NUCLEAR CHEMISTRY, HETEROATOMS AND SOLUTION THERMODYNAMICS	DSE-5	4	2
V	CH520DB	CHEMISTRY OF BIO-MOLECULES	DSE-6	4	2
VI	CH620DA	SPECTROSCOPY	DSE-6	4	2
VI	CH620DB	ENVIRONMENTAL AND GREEN CHEMISTRY	DSE-6	4	2

**B.Sc. 1<sup>st</sup> SEMESTER  
DISCIPLINE SPECIFIC COURSE (CORE)**

**CH120C: CHEMISTRY**

**Max. Marks: 60**

**Course Weightage: 04 Credit (Theory)**

**No. of Contact Hours: 60**

**Course Objectives:**

To introduce students to basic concepts of chemical bonding, S-block elements, general organic chemistry and states of matter.

**Course outcomes: The students after learning the course will be able to:**

1. Understand the nature and strength of forces between chemical constituents.
2. Understand the applications of different theories of chemical bonding.
3. Gain knowledge about the chemical reactivity of S-Block elements.
4. Understand stereochemical aspects of organic molecules.
5. Acquire knowledge of aromaticity and reaction intermediates.
6. Understand the structural and behavioral aspects of matter in solid, liquid and gaseous states.

**UNIT-I: Chemical Bonding and Molecular Structure (15 Contact hours)**

**Ionic bond:** Lattice energy and Born Haber Cycle. Factors affecting the structure of ionic solids; Radius ratio effect; Coordination number and limitations of radius ratio rule. Solvation energy and solubility of ionic solids.

**Covalent bond:** Formation of hydrogen molecule, Polarity in covalent bonds, Covalent-character of ionic bond, Fajan's rules, Percentage ionic character of a polar covalent bond. Dipole moment.

**Valence bond theory:** Directional characteristics of covalent bond and types of hybridizations. Limitations of VB theory.

**VSEPR theory:** Assumptions; geometry of covalent molecules (BeF<sub>2</sub>, BF<sub>3</sub>, CH<sub>4</sub>, PCl<sub>5</sub>, SF<sub>6</sub>, SnCl<sub>2</sub>, NH<sub>3</sub>, H<sub>2</sub>O, SF<sub>4</sub>, ClF<sub>3</sub> and XeF<sub>2</sub>).

**Molecular orbital theory:** MO treatment of homo & hetero nuclear diatomic molecules (N<sub>2</sub>, O<sub>2</sub>, CO & NO). Energy level diagrams, Bond order and applications.

**UNIT II: S-Block Elements (15 Contact hours)**

**Electronegativity and electron affinity:** Determination and applications. Effective nuclear charge, Slater rules and its applications.

Position of hydrogen in periodic table. Isotopes of hydrogen.

Chemical reactivity of s-block elements towards water, oxygen, nitrogen and halogens. Anomalous behaviour and diagonal relationships (Lithium, Beryllium, Magnesium and Aluminum). Solubility of alkali metals in ammonia, Ionic conductance.

Chemical characteristics of the compounds of alkali and alkaline earth metals; oxides and hydroxides, carbonates, sulphates, halides. Hydrides and their classification.

### Unit III: General Organic Chemistry

(15 Contact Hours)

**Reactive intermediates:** Structure, generation and stability of carbocations, carbanions, free-radicals, carbenes, benzyne and nitrenes.

**Aromaticity:** Molecular orbital description of benzene. Requirements of aromaticity. Huckel's rule and its significance. Antiaromatics and non-aromatics. Aromaticity of non-benzenoid compounds like pyrrole, thiophene, furan, pyridine and aromatic ions (3, 5 and 7-membered rings).

**Stereochemistry:** Chirality (up to 2 carbon atoms), Interconversion of Wedge formula, Newmann, Sawhorse and Fischer representations, Conformers, Conformations with respect to ethane, butane and cyclohexane.

**Geometrical Isomerism:** *Cis-trans*-nomenclature, *E/Z* nomenclature (up to two C=C systems).

**Optical isomerism:** Enantiomerism, Diastereomerism and Meso compounds. D and L system. CIP rules: R/S (for up to 2 chiral carbon atoms). Threo and erythro isomers.

### UNIT-IV: STATES OF MATTER

(15 Contact hours)

**Gaseous State:** Deviation of gases from ideal behavior, van der Waal's equation of state.

**Critical Phenomenon:** PV isotherms of real gases, continuity of states, the isotherms of van der Waal's equation. Relationship between critical constants and van der Waal's constants, the law of corresponding states, reduced equation of state.

**Molecular velocities:** Qualitative discussion of the Maxwell's distribution of molecular velocities. root mean square, average and most probable velocities; collision number, mean free path and collision diameter.

**Liquid State:** Vapour pressure, Viscosity and Surface tension of liquids.

**Solid State:** Laws of crystallography: (i) Law of constancy of interfacial angles (ii) Law of rational indices and (iii) Law of symmetry

Symmetry elements in crystals, lattice planes and miller indices. Bragg's equation and derivation. Interplanar distances in terms of miller indices.

### BOOKS RECOMMENDED:

1. Concise Inorganic Chemistry; J.D. Lee; 5<sup>th</sup>Edn., OUP/Wiley India Pvt. Limited, 2008
2. Chemistry of the Elements; N. N. Greenwood, A. Earnshaw; 2<sup>nd</sup> Edn, Elsevier India, 2010.
3. Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33<sup>rd</sup>Edn., Milestone Publishers & Distributors/ Vishal Publishing Co., 2017
4. Advanced General Organic Chemistry: A Modern Approach; S.K. Ghosh; 3<sup>rd</sup> Revised Edn, New Central, 2010.
5. Organic Chemistry; R.T. Morrison, R.N. Boyd, S. K. Bhattacharjee; 7<sup>th</sup>Edn, Pearson India, 2011.
6. Organic Chemistry; P.Y. Bruice; 8<sup>th</sup>Edn, Pearson Education, 2017.
7. Solomons Organic Chemistry; T. W. G. Solomons, C. B. Fryhle, Scott A. Snyder; Global Edn, Wiley, 2017.
8. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure; M. B. Smith; 7<sup>th</sup> Edition, Wiley, 2013.
9. Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47<sup>th</sup>Edn, Vishal Pubs & Co, 2017.
10. Atkins' Physical Chemistry; P. Atkins, J. de Paula, J. Keeler; 11<sup>th</sup>Edn. Oxford University Press, 2018.
11. Physical Chemistry; T. Engel, P. Reid, 3<sup>rd</sup>Edn, Pearson India, 2013.
12. A Textbook of Physical Chemistry, States of Matter and Ions In Solution (SI Units) - Vol. 1; K.L Kapoor; 6<sup>th</sup>Edn, McGraw Hill Education, 2019.

**Section A: Inorganic Chemistry - Volumetric Analysis**

1. Preparation of primary standards (Acid, Base, Redox).
2. Titration and standardization of solutions (Acid-Base and Redox)

**Section B: Organic Chemistry**

1. Purification of organic compounds by crystallization (from water and alcohol) and sublimation.
2. Detection of N, S and halogens in organic compounds.

**Section C: Physical Chemistry**

1. Surface tension measurement (use of organic solvents excluded).
  - a. Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.
  - b. Study of the variation of surface tension of a detergent solution with concentration.
2. Viscosity measurement (use of organic solvents excluded).
  - a) Determination of relative viscosity of a liquid or dilute solution using an Ostwald's viscometer.
  - b) Study of the variation of viscosity of an aqueous solution with concentration of solute.

**Books Recommended:**

1. Vogel's Qualitative Inorganic Analysis; G. Svehla; 7th Ed., Pearson Education. 2013,
2. Vogel's Textbook of Quantitative Inorganic Analysis; Bassett, G. H. Jeffery, J. Basset, J. Mendham, R. C. Denny, 6<sup>th</sup> ed., ELBS; 2007.
3. Advanced Practical Inorganic Chemistry; Gurdeep Raj; Krishna Prakashan Media (P) Ltd; 2013.
4. Vogel's Textbook of Practical Organic Chemistry; B.S. Furniss, A.J. Hannaford, P.W.G. Smith, & A.R., Tatchell; 5th Edn., Pearson India, 2003.
5. Practical Organic Chemistry; F.G. Mann, & B.C. Saunders; Orient-Longman, 1960.
6. Laboratory Manual in Organic Chemistry; R.K. Bansal; 5<sup>th</sup> Revised Edn, Nw Age International Limited, 2008.
7. Comprehensive Practical Organic Chemistry: Qualitative analysis Ahluwalia, V.K. & Sunita Dhingra; Universities Press, India, 2004.
8. Advanced Practical Organic Chemistry; N. K. Vishnoi; 3<sup>rd</sup>Edn; Vikas Publishing, 2009.
9. Advanced Practical Physical Chemistry; J.B. Yadav; Krishna Prakashan Media (P) Limited, 2015.
10. Advanced Physical Chemistry Experiments; J. N. Gurtu, A. Gurtu, PragatiPrakashan, 2008.