

ANNEXURE G

FACULTY OF SCIENCES

SYLLABUS FOR THE

SUBJECT: CHEMISTRY

For the award of the Degree in

Bachelor of Science/Honours

(Offered under 4 Year U.G. Degree Programme)

(Credit Based Continuous Evaluation Grading System)

Under NEP-2020

Semester I-II

Session: 2025-26



**The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR
(AUTONOMOUS)**

KANYA MAHA VIDYALAYA JALANDHAR (AUTONOMOUS)

**SCHEME AND CURRICULUM OF EXAMINATION OF FOUR YEAR UNDER
GRADUATE DEGREE PROGRAMME**

**Bachelor of Science/Honours
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Session: 2025-26)**

Bachelor of Science/Honours (Semester I)										
Course Name	Hours Per Week L-T-P	Credits L-T-P	Course Code	Course Type	Total marks	Paper	Ext.		CA	Examination Time (in Hours)
							L	P		
Chemistry	4-0-0	4-0-0	BSNL/BSML-1084	C	100	Chemistry (Inorganic Chemistry-I)	70	-	30	3
	0-0-4	0-0-2	BSNP/BSMP-1084	C	50	Chemistry (Inorganic Chemistry- I Lab)	-	35	15	3

Bachelor of Science/Honours
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2025-26)
(Semester I)
COURSE CODE: BSNL/BSML-1084
COURSE TITLE: Chemistry (Inorganic Chemistry-I)

Course Outcomes:

Students will be able to

CO1: Predict electronic properties of atoms using current models and theories in chemistry, sketch the probability density curves, identify the periodic trends in physical and chemical properties of elements, describe the arrangement of the elements in the Periodic Table & change from metallic to nonmetallic character.

CO2: Describe VBT, VSEPR theory and predicts the geometry of simple molecules & molecular orbital theory of homonuclear diatomic molecules, explain, predict & draw structures of simple ionic compounds.

CO3: Explains & compares the trends in atomic and physical properties of p-block elements, explain the atomic, physical and chemical properties of alkali metals and alkaline earth metals and concepts of Acids and Bases.

CO4: Detailed studies of Group 13 and 14 of p-block elements.

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(Semester I)
COURSE CODE: BSNL/BSML-1084
COURSE TITLE: Chemistry (Inorganic Chemistry-I)

Exam Time: 3Hrs.
Credit(L-T-P): 4-0-0

Max. Marks: 100
(Theory: 70, CA: 30)

Instructions for the Paper Setters: Eight questions of equal marks (fourteen marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Unit I **(15 Hrs.)**

Atomic Structure- Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, Quantum numbers, Shapes of s, p, d and f orbitals. Aufbau's and Pauli's Exclusion principle, Hund's multiplicity rule. Electronic configurations of the elements and ions.

Periodic Properties- Position of elements in the periodic table; effective nuclear charge and its calculations. Details of atomic and ionic radii, ionization energy, electron affinity and electronegativity.

Unit II **(15 Hrs.)**

Ionic Solids: Concept of close packing, Ionic structures, radius ratio rule and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle. Fajan's rule, Weak Interactions –Hydrogen bonding, van der Waals forces.

Chemical Bonding-I: Covalent Bond-Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, Valence shell electron pair repulsion (VSEPR) theory, homonuclear and heteronuclear diatomic molecules. Multicentre bonding in boranes, Percentage ionic character from dipole moment and electronegativity difference.

Unit-III

(15 Hrs.)

s- and p-block elements and their comparative study: General remarks about each group (I-VIII), trends in electronic configuration, atomic and ionic radii, ionization potential, electron affinity, electronegativity, oxidation states, Melting and boiling point, density, electropositive or metallic character, flame colouration. Lattice energies. Photoelectric effect, inert pair effect, catenation and hetero catenation. Anomalies in first and second row elements. Chemical properties in details.

Acids and Bases: Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases

Unit-IV

(15 Hrs.)

p-Block Elements: Group 13: General characteristics, Atomic and ionic radii, melting and boiling point, Ionisation energies, Oxidation states, Electropositive character, Tendency to form covalent compounds. **Compounds of group 13:** Hydrides, Oxides and hydroxides, Oxoacid; Structure and Properties of Boric acid, Preparation, properties and structure of Diborane, Borazine, Boron halides: Boron hydrides (LiBH_4 , NaBH_4), Anomalous behaviour of Boron and its diagonal relationship with Silicon.

Group 14: General characteristics; Atomic radii, Ionisation energies, Melting and boiling point, oxidation state, metallic character, catenation, Allotropy, Tendency to form multiple bonding.

Compounds of group 14: Hydrides of silicon: preparation and properties, toxic nature of CO, Dioxide of carbon and silicon. Comparison of carbon tetrachloride and silicon tetrachloride. Chemistry of Fullerenes.

Books Suggested

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.
3. Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.
4. Douglas, B. McDamiel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.
5. Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
6. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw-Hill Publishing Company Limited, 1991.
7. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
8. Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.

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(Semester I)
COURSE CODE: BSNP/BSMP-1084
COURSE TITLE : Chemistry (Inorganic Chemistry-I Lab)

Course outcomes

Students will be able

- CO1: To develop technical skills relevant to quantitative analysis
- CO2: To separate and identify the various ions present in the mixture
- CO3: To understand and master the technique of volumetric analysis
- CO4: To analyze an acidic and alkali content in different samples

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(Semester I)
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Time: 3 Hrs

Marks: 50

Credits: 0-0-2

(Practical: 35, CA: 15)

Semi Micro analysis. Cation analysis, Separation and identification of ions from groups I, II, III, IV, V, and VI. Anionic analysis. Four ions with no interference.

Volumetric titrations

1. Determination of strength of Na_2CO_3 solution by titrating it against a standard solution of HCl .
2. Determination of molarity of KMnO_4 solution by titrating it against a standard solution of Oxalic acid.
3. Standardise the given $\text{K}_2\text{Cr}_2\text{O}_7$ solution by titrating it against a standard solution Of Mohr's Salt.
4. Estimation of free alkali present in different soaps/detergents
5. Estimation of Cu(II) and $\text{K}_2\text{Cr}_2\text{O}_7$ using sodium thiosulphate solution (Iodimetrically).
6. Estimation of available chlorine in bleaching powder iodometrically.

Books Suggested

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.

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Bachelor of Science/Honours
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(Session: 2025-26)
(Semester II)
COURSE CODE: BSNL/BSML-2084
COURSE TITLE: Chemistry (Organic Chemistry-I)
(THEORY)

Course outcomes:

Students will be able to

CO1: interpret the bonding, hybridization between different organic compounds, explain the various reaction mechanisms and different electron displacement effects

CO2: interpret the reactions and properties of alkanes, alkenes & alkynes, derive the electrophilic, nucleophilic addition reactions, free radical mechanisms of halogenation of alkanes.

CO3: differentiate between aromatic, anti-aromatic and non-aromatic compounds, explain the effect of various substituents on the reactivity of aromatic compounds

CO4: learn about the basic chemistry of organic compounds along with methods of formation and reactions of alkyl halides and their derivatives.

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COURSE TITLE: Chemistry (Organic Chemistry-I)
(THEORY)

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Max. Marks: 100

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UNIT-I

Hybridization, Use of arrows, Types of reagents, Reactive Intermediates: Carbocations, Carbanions, Free radicals Carbenes, arenes and Nitrenes. Stereochemistry: Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions, Geometrical isomerism, E/Z notations with C.I.P rules, Optical Activity, enantiomeric and diastereomeric excess, Chirality/Asymmetry, Enantiomers, Diastereoisomers, Racemic mixture and resolution, optical activity in absence of chiral carbon, Relative and absolute configuration: D/L and R/S designations

UNIT-II

Chemistry of alkanes: methods of formation of alkanes, Free radical substitutions: Halogenation - relative reactivity and selectivity. Cycloalkanes and Conformational Analysis: Baeyer strain theory, Conformation analysis, relative stability and energy diagrams of ethane, propane, butane, cyclohexane and Chair, Boat and Twist boat forms of cyclohexane.

Chemistry of alkenes/alkynes: Nomenclature and Formation of alkenes and alkynes, Mechanism of E1 and E2 reactions, Saytzeff and Hofmann eliminations. Mechanisms and Reactions of alkenes, reduction, syn and anti-hydroxylation (oxidation), 1, 2- and 1,4- addition reactions in conjugated dienes and Diels-Alder reaction, mechanism of allylic and benzylic bromination. Reactions of alkynes.

UNIT-III

Aromaticity: Huckel's rule, Structure of benzene: Molecular formula and Kekule structure. Stability and C-C bond lengths of benzene, resonance structure. Aromatic electrophilic substitution—general pattern of the mechanism, role of σ and π complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, reactivity and orientation of disubstitution. Side chain reactions of benzene derivatives. Methods of formation and chemical reactions of alkylbenzenes.

UNIT-IV

Alkyl halides: Methods of preparation, details of nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent, nucleophilic substitution vs. elimination. Aryl halides: Preparation, including preparation from diazonium salts, nucleophilic aromatic substitution in details; SNAr, Benzyne mechanism. Relative reactivity and mechanism of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions in detail.

Books suggested

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Solomons, T. W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
4. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.
5. Fundamentals of Organic Chemistry, Solomons, John Wiley.
6. Introduction to Organic Chemistry, Sreiwieser, Heathcock and Kosover, Macmilan.
7. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
8. McMurry, J. E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
9. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.

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Course outcomes:

Students will be able to analyze the given organic compound through

CO1: understand the basics of Qualitative analysis

CO2: detection of elements (N, S and halogens) in organic compounds.

CO3:detection of functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines,amides, nitro and anilide) in simple organic compounds

CO4: preparation of their derivatives

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Time: 3 Hrs

Marks: 50

Credits: 0-0-2

(Practical: 35, CA: 15)

Basic techniques on purification of organic compounds. Determination of melting point and boiling point of organic compounds. Detection of nitrogen, halogens and sulphur in organic compounds. Qualitative analysis of unknown organic compounds containing simple functional groups.

Books Suggested

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5 th Ed. Pearson (2012)
3. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
4. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).