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: 2026-27

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: 2026-27)

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: 2026-27)
(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.

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(Semester I)
COURSE CODE: BSNL/BSML-1084
COURSE TITLE: Chemistry (Inorganic Chemistry-I)

Exam Time: 3Hrs. **Max. Marks: 100**
Credit (L-T-P): 4-0-0 **(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 EducationInc., 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.

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(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

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(Semester I)
COURSE CODE: BSNP/BSMP-1084
COURSE TITLE : Chemistry (Inorganic Chemistry-I Lab)

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 $K_2Cr_2O_7$ 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 $K_2Cr_2O_7$ 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.

KANYA MAHA VIDYALAYA JALANDHAR (AUTONOMOUS)

SCHEME AND CURRICULUM OF EXAMINATION OF FOUR YEARS UNDER GRADUATE DEGREE PROGRAMME

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Session: 2026-27)

Bachelor of Science (Honours) (Semester II)										
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**		
	4-0-0	4-0-0	BSNL/BSML-2084	C	100	Chemistry (Organic Chemistry-I)	70	-	30	3
	0-0-4	0-0-2	BSNP/BSMP-2084	C	50	Chemistry (Organic Chemistry-I Lab)	-	35	15	3

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(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.

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(Semester II)
COURSE CODE: BSNL/BSML-2084
COURSE TITLE: Chemistry (Organic Chemistry-I)
(THEORY)

Exam Time: 3Hrs. **Max. Marks: 100**
Credit(L-T-P): 4-0-0 **(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

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, Sireitwieser, 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 IndiaEdition, 2013.
9. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London,1994.

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(Semester II)
COURSE CODE: BSNP/BSMP-2084
COURSE TITLE : Chemistry (Organic Chemistry-I Lab)

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

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(Semester II)
COURSE CODE: BSNP/BSMP-2084
COURSE TITLE : Chemistry (Organic Chemistry-I Lab)

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).

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 III

Session: 2026-27

The Heritage Institution
KANYA MAHA VIDYALAYA
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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: 2026-27)

Bachelor of Science (Honours) (Semester III)										
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-3084	**C**	100	Chemistry (Physical Chemistry-I)	70	-	30	3
	0-0-4	0-0-2	BSNP/BSMP-3084	**C**	50	Chemistry (Physical Chemistry-I Lab)	-	35	15	3

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(Semester III)
COURSE CODE: BSNL/BSML-3084
COURSE TITLE: Chemistry (Physical Chemistry-I)

Course Outcomes:

Students will be able to

CO1: Explain the fundamental principles governing the gaseous and liquid states, including kinetic theory, van der Waals equation, critical phenomena, and molecular velocity distributions.

CO2: Describe the properties and classification of colloids and crystals, analyze colloidal stability, and interpret crystal structures using X-ray diffraction techniques.

CO3: Apply the concepts of ideal and non-ideal solutions to determine colligative properties, calculate molecular weights, and explain deviations using thermodynamic and experimental methods.

CO4: Analyze electrochemical systems using concepts like conductivity, electrode potentials, Nernst equation, and concentration cells, and evaluate electrochemical parameters such as EMF, ΔG, ΔH, and equilibrium constants.

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2025-2026)
(Semester III)
COURSE CODE: BSNL/BSML-3084
COURSE TITLE: Chemistry (Physical Chemistry-I)

Exam Time: 3Hrs. **Max. Marks: 100**
Credit(L-T-P): 4-0-0 **(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.)

Gaseous States: Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of State. Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of van der Waal's equation, relationship between critical constants and van der Waals constants, the law of Corresponding states, reduced equation of state. Molecular Velocities: Root mean square, average and most probable velocities. Qualitative Discussion of the Maxwell's distribution of molecular velocities. Collision number, mean free path and collision diameter. Liquefaction of gases. **Liquid State**: Intermolecular forces, surface tension and viscosity of liquids and its determination. Structure of liquids (a qualitative description). Structural differences between solids, liquids and gases.

UNIT II (15 Hrs.)

Colloidal State: Definition of colloids, classification of colloids. Solids in liquids (Sol): kinetic, optical and electrical properties, stability of colloids, protective action, Hardy Schulze law, gold number. Liquids in liquids (emulsions): Types of emulsions, preparation. Emulsifiers. General applications of colloids.

Solid State: Definition of space lattice and unit cell, Law of crystallography- (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices, (iii) Symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg's Law in Reciprocal space. Determination of crystal structure of NaCl, KCl by use of Powder method; Laue's method. Liquid crystals, Classification, structure of nematic and cholestric phases.

UNIT III (15 Hrs.)

Solutions, Dilute Solutions and Colligative Properties: Ideal and non–ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, non-ideal system, azeotropes-HCl-H2O and ethanol-water system. Relative lowering of vapour pressure, molecular weight determination. Osmosis, Law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

Electrochemistry–I: Specific conductance and equivalent conductance, measurement of equivalent conductance, Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations.

UNIT IV (15 Hrs.)

Electrochemistry–I: Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Migration of ions, Transport number, Applications of conductivity measurements, Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells. Standard electrode potential, standard hydrogen electrode, reference electrodes, sign conventions, electrochemical series and its significance. Nernst equation, derivation of cell E.M.F. and single electrode potential. EMF of a cell and its measurements. Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K). Types of reversible electrodes: gas-metal ion, metal ion, metal insoluble salt-anion and redox electrodes. Electrode reactions. EMF of reversible electrodes.

Electrochemistry–II: Polarization, over potential, hydrogen overvoltage and its application. Concept of activities and activity coefficient. Concentration cells with and without transference, liquid junction potential, application of concentration cells, valency of ions, solubility product and pH determination, potentiometric titrations.

Books Suggested

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs: Wiley Eastern Limited, 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
10. University General Chemistry, C.N.R. Rao, Macmillan.
11. Metz, C.R., Theory and problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book Company, 1989.

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(Semester III)
COURSE CODE: BSNP/BSMP-3084
COURSE TITLE : Chemistry (Physical Chemistry – I: Lab)

Course outcomes

Students will be able

CO1: Perform acid-catalyzed hydrolysis of esters and evaluate the specific reaction rate and effect of acid strength, applying principles of chemical kinetics.

CO2: Determine physical properties of liquids such as viscosity, surface tension, and refractive index using standard laboratory techniques and calculate related molecular parameters.

CO3: Analyze and interpret crystallographic data from X-ray powder diffraction patterns for crystal system identification and indexing.

CO4: Prepare buffer solutions and perform pH metric titrations to determine dissociation constants, enhancing understanding of acid-base equilibria and solution chemistry.

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2024-2025)
(Semester III)
COURSE CODE: BSNP/BSMP-3084
COURSE TITLE : Chemistry (Physical Chemistry – I: Lab)

Time: 3 Hrs **Marks: 50**
Credits: 0-0-2 **(Practical: 35, CA: 15)**

1. To determine the specific reaction rate of hydrolysis of ethyl acetate catalysed by acid at room temperature.
2. To study the effect of acid strength on hydrolysis of an ester.
3. To find the relative and absolute viscosity of given liquid at room temperature. (n-butyl alcohol, sucrose, and glycerine solution in water)
4. To study the surface tension of liquids by drop number and drop weight methods.
5. To determine the Refractive indices of given liquids (water, acetone, methanol, ethyl acetate, cyclohexane) by Abbe's refractometer & calculate their molecular refractivity.
6. To determine the composition of unknown mixture of two liquids by refractive index measurements.
7. Indexing of a given powder diffraction pattern of a cubic crystalline system.
8. Preparation of buffer solutions of different pH (a) Sodium acetate-acetic acid (b) Ammonium chloride-ammonium hydroxide
9. pH metric titration of (a) strong acid vs. strong base, (b) weak acid vs. strong base.
10. Determination of dissociation constant of a weak acid.

Books Suggested

1. Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
3. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
4. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
5. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
6. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
7. Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand & Co.
8. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh & Sons.
9. Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.
10. Findlay's Practical Physical Chemistry, Author: Alexander Findlay, Publisher: Wiley, 1972, ISBN-10:0470258853.
11. Advanced Practical Physical Chemistry, Author: J. B. Yadav, Publisher: Krishna Prakashan Media (P) Ltd (2015), ISBN-10:8182835925.

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 IV

Session: 2026-27

The Heritage Institution
KANYA MAHA VIDYALAYA
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SCHEME AND CURRICULUM OF EXAMINATION OF FOUR YEARS UNDER GRADUATE DEGREE PROGRAMME

Bachelor of Science (Honours)

Credit Based Continuous Evaluation Grading System (CBCEGS)

(Session: 2026-27)

Bachelor of Science (Honours) (Semester IV)										
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-4084	C	100	Chemistry (Inorganic Chemistry-II)	70	-	30	3
	0-0-4	0-0-2	BSNP/BSMP-4084	C	50	Chemistry (Inorganic Chemistry-II Lab)	-	35	15	3

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(Semester II)
COURSE CODE: BSNL/BSML-4084
COURSE TITLE: Chemistry (Inorganic Chemistry-II)

Course outcomes:

Students will be able to

CO1 : Explain the periodic trends, chemical properties, and structures of p-block elements and their compounds, including sulphur and halogen oxoacids, interhalogens, and industrial processes like the Contact Process for sulphuric acid.

CO2 : Compare and contrast the electronic structure, oxidation states, and magnetic properties of d- and f-block elements, including the effects of lanthanide and actinide contraction and their analytical applications.

CO3 : Analyze the structure, bonding, stability, and stereochemistry of coordination compounds using Werner's theory, valence bond theory, and ligand field considerations.

CO4: Interpret electronic spectra of transition metal complexes using Orgel diagrams and selection rules, and describe the structure, bonding, and reactivity of organometallic compounds including their role in catalysis

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(Semester IV)
COURSE CODE: BSNL/BSML-4084
COURSE TITLE: Chemistry (Inorganic Chemistry-II)

Exam Time: 3Hrs. **Max. Marks: 100**
Credit (L-T-P): 4-0-0 **(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.)

p–Block Elements: Group 16: General characteristics: atomic radii, Ionisation energies, Melting and boiling point, Electron affinity, Oxidation state, Catenation, Elemental state, Allotropy, Hydrides of group 16, Chemical properties of SO_2, structure of SO_2 & SO_3, Oxoacid of sulphur: structure and basicity. Preparation of sulphuric acid by contacts process and its chemical properties

Group 17: General characteristics: atomic radii, Ionisation energies, melting and boiling point, Electron affinity, Electronegativity, Non-metallic character, colour, Oxidation state and reactivity**,** Hydrides of group 17, Relative acidic strength of hydro acids and Oxoacids of group 17, structure of interhalogen compounds and polyhalides.

Important compounds of p-block: Carbides, fluorocarbons, Silicones and phosphazenes, triphosphazenes.

UNIT -II (15 Hrs.)

Chemistry of Transition Elements: General characteristics of Transition Elements. Properties of the elements of the first transition series, Relative stability of their oxidation state. Coordination number and geometry. General characteristics of elements of Second and Third Transition Series. Difference in the properties of first transition elements with second and third transition series elements in respect of ionic radii, oxidation states, magnetic behaviour.

***f*-block elements**: Lanthanoids: Electronic configurations, oxidation states, ionic radii, lanthanide contraction, colour, spectral and magnetic properties, lanthanum compounds. Actinoids: electronic configurations, oxidation states, ionic radii, actinide contraction, colour, spectral and magnetic properties. Comparison of lanthanoids and actinoids and their analytical applications.

UNIT-III (15 Hrs.)

Coordination Compounds: Nomenclature of coordination compounds, Werner's coordination theory, effective atomic number, polydentate, chelating ligands and chelation, factors affecting stability of chelates, structural and stereoisomerism in coordination compounds with co-ordination number 4 and 6, resolution of racemic mixture, Valence bond theory of transition metal complexes, hybridization and geometry of complexes of Cr, Fe, Co, Cu and its ions, Magnetic properties and colour of coordination compounds.

Transition Metal complexes: an elementary idea of crystal field theory, Jahn-Teller effects. methods of determining magnetic susceptibility by Gouy's and Faraday method. L-S coupling, correlation of μs and μeff values, Nucleophilic Substitution reactions in square planar complexes

UNIT-IV (15 Hrs.)

Electronic Spectra of Transition Metal Complexes: Types of electronic transitions, selection rules and relaxations, splitting of Russel-Saunder states in octahedral and tetrahedral, spectrochemical series, Orgel diagram of one electron-one hole system and two electron-two hole system in octahedral and tetrahedral complexes. Limitation of Orgel diagram.

Organometallic Compounds: Definition, nomenclature and classification of organometallic compounds. σ and π complexes, types of organoligands, EAN rule, bonding in organometals, Preparation, properties, bonding and applications of alkyl lithium and organoaluminium compounds (AlR_3). Metal olefin complexes, bonding in metal-ethylenic complexes, Mechanism of homogeneous hydrogenation reactions of alkene. Metal carbonyls: examples and bonding.

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. Porterfield, W.W., Wesley, A., Inorganic Chemistry; Pubs: Addison-Wesley Publishing Company, 1984.
6. Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
7. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw-Hill Publishing Company Limited, 1991.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
9. Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
10. Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
11. Inorganic Chemistry, A.G. Sharpe, ELBS.

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(Semester IV)
COURSE CODE: BSNP/BSMP-4084
COURSE TITLE : Chemistry (Inorganic Chemistry-II Lab)

Course outcomes:

Students will be able to analyze the given organic compound through

CO1: Perform volumetric titrations for the quantitative analysis of substances such as acetic acid, antacids, and water hardness using appropriate indicators and standard solutions.

CO2: Apply redox titration techniques (e.g., permanganometry, dichromate method, iodometry) to estimate metal ions like calcium, iron, and copper with accuracy and precision.

CO3: Execute gravimetric analysis procedures for the estimation of metal ions like copper, nickel, and silver through selective precipitation and weighing of pure compounds.

CO4: Synthesize and characterize simple inorganic compounds such as Prussian Blue, potash alum, and copper acetylacetonate, demonstrating understanding of coordination chemistry and crystallization techniques

Bachelor of Science (Honours)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Under NEP 2020)
(Session: 2026-27)
(Semester IV)
COURSE CODE: BSNP/BSMP-4084
COURSE TITLE : Chemistry (Inorganic Chemistry-II Lab)

Time: 3 Hrs **Marks: 50**
Credits: 0-0-2 **(Practical: 35, CA: 15)**

Volumetric Analysis

1. Determination of acetic acid in commercial vinegar using NaOH.
2. Determination of alkali content-antacid tablet using HCI.
3. Estimation of calcium content in chalk as calcium oxalate by permanganometry.
4. Standardisation of EDTA with $Pb(NO3)2$ / $ZnSO4$. $7H2O$ and Estimation of hardness of water by EDTA.
5. Estimation of ferrous and ferric by dichromate method.
6. Estimation of copper using sodium thiosulphate.

Gravimetric Analysis

Analysis of Cu as CuSCN; Ni as Ni (dimethylgloxime) and Determination of silver (I) as its chloride

Inorganic Preparations

Synthesis of Iron(III) Hexacyanoferrate(II) $Fe4[Fe(CN)6]3$ (Prussian Blue).

Preparation of Potassium Aluminum Sulfate $KAl(SO_4)\cdot 12\ H_2O$ (Potash Alum)

Preparation of bis Acetylacetonate Copper(II) $Cu(O_2C_5H_7)_2$.

Books Suggested

1. Vogel's Textbook of Quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Jeffery and J. Mandham, ELBS.
2. Standard Methods of Chemical. Analysis, W.W. Scott: The Technical Press.
3. Experimental Inorganic Chemistry, W.G. Palmer, Cambridge.
4. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
5. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
6. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
7. Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
8. Marr, G. and Rockett, B.W. Practical Inorganic Chemistry, 1972.