

**Department of Chemistry, Kalna College**

**Course Outcomes: B.Sc.(Hons) Chemistry**

**Semester-I (Hons.)**

<b>Course</b>	<b>Outcomes After completion of these courses studentsshould be able</b>
CC-1 Organic Chemistry	CO-1. To learn about bonding and physical properties of organic molecules CO-2. To learn general treatment of reaction mechanism CO-3. To learn stereochemistry of organic molecules CO-4. To learn separation techniques, determination of boiling point and identification of organic compounds
CC-2 Physical Chemistry	CO1. To learn properties and behaviors of gaseous state CO-2. To learn chemical thermodynamics and its application CO-3. To learn kinetics of chemical reactions CO-4. To study kinetics of chemical reactions experimentally and determination of pH and solubility product

**Semester-II (Hons.)**

<b>Course</b>	<b>Outcomes After completion of these courses studentsshould be able</b>
CC-3 Inorganic Chemistry	CO-1. To learn about extranuclear structures of atoms CO-2. To learn chemical periodicity CO-3. To learn about acid base reactions, redox reactions and precipitation reactions CO-4. To learn redox titrations (experimentally)
CC-4 Organic Chemistry	CO1. To learn stereochemistry of organic molecules CO-2. To learn general treatment of reaction mechanism

	CO-3. To learn substitution and elimination reactions in organic chemistry CO-4. To prepare organic compounds, purify them and to determine melting point
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**Semester-III (Hons.)**

Course	Outcomes After completion of these courses students should be able
CC-5 Physical Chemistry	CO-1. To learn about transport process CO-2. To learn application of thermodynamics in chemistry CO-3. To learn about basic quantum mechanics CO-4. To determine viscosity, partition coefficient, equilibrium constant and to perform conductometric experiments
CC-6 Inorganic Chemistry	CO1. To learn chemical bonding CO-2. To learn radioactivity and nuclear structure CO-3. To learn about iodometric and iodimetric titrations experimentally
CC-7 Organic Chemistry	CO-1. To learn about chemistry of alkenes and alkynes CO-2. To learn aromatic substitutions CO-3. To learn about carbonyl compounds and organometallic reagents CO-4. To detect special elements and functional groups in organic compounds and to prepare suitable derivatives
SEC-1/I	CO-1. To learn about fundamental mathematical procedure and their applications in chemistry CO-2. To learn computer programming for statistical analysis CO-3. To handle numeric data
SEC-1/II	To learn about application of basic analytical procedures in chemistry

**Semester-IV (Hons.)**

Course	Outcomes After completion of these courses students should be able
CC-5 Physical Chemistry	CO-1. To learn about transport process CO-2. To learn application of thermodynamics in chemistry CO-3. To learn about basic quantum mechanics CO-4. To determine viscosity, partition coefficient, equilibrium constant and to perform conductometric experiments
CC-8 Physical Chemistry	CO1. To learn about colligative properties CO-2. To learn about phase rule and different kinds of equations CO-3. To learn about ionic equilibria and electromotive force CO-4. To know about the quantum chemistry CO-5. To studies the determination of solubility products, potentiometric titration and phase diagrams
CC-9 Inorganic Chemistry	CO-1. To learn about general principle of metallurgy CO-2. To learn about chemistry of s and p block elements and also on inorganic polymers CO-3. To learn about basic coordination chemistry CO-4. To studies complexometric titration and inorganic preparation of complex salts
CC-10 Organic Chemistry	CO-1. To studies about nitrogen compounds and various types of name reactions CO-2. To know about the rearrangement reaction and stereochemical features of aliphatic and aromatic compounds CO-3. To studies retrosynthesis analysis, ring synthesis, asymmetric synthesis CO-4. To learn about UV, IR and NMR spectroscopy CO-5. To learn about the estimation of organic compounds experimentally
SEC-2/I	CO-1. To learn about pharmaceuticals chemistry including drugs CO-2. To study about fermentation

SEC-2/II	CO-1. To learn about Analytical Clinical biochemistry
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**Semester-V (Hons.)**

Course	Outcomes After completion of these courses students should be able
CC-11: Inorganic Chemistry-IV	<p>CO-1. To learn about CFSE, CFAE, splitting in Oh, Td, square planar and TBP geometry. Also learn about colour property, origin of magnetism, Orgel diagram, term symbol, detailed M.O. of oh and td complexes.</p> <p>CO-2. To study the chemistry of 3d, 4d and 5d transition metals in terms of oxidation state, electronic configuration, redox property and coordination Chemistry.</p> <p>CO-3. To learn about the chemistry of lanthanide and actinides.</p> <p>CO-4. Study about chromatographic separation of different metal ions, gravimetry and spectrophotometric determination of 10Dq and maximum absorption.</p>
CC-12: Organic Chemistry-V	<p>CO-1: To learn methods of syntheses (with reactions mechanism) of Carbocycles and Heterocycles and their derivatives.</p> <p>CO-2: To learn methods of syntheses (with reactions mechanism) of Heterocyclic compounds and their derivatives.</p> <p>CO-3: To learn cyclic stereochemistry and different reaction mechanism of the Alicyclic compounds.</p> <p>CO-4: To learn mechanism, stereochemistry, regioselectivity in case of pericyclic reactions.</p> <p>CO-5: To learn structure, bonding and reactions of bio-molecules i.e. amino acids and nucleic acids.</p> <p>CO-6: To learn general properties and structure determination of Alkaloids and Terpenoids.</p> <p>CO.-7: To learn about Chromatographic Separations and spectroscopic analysis of organic compounds.</p>

DSE-1: Compulsory Course (Advanced Physical Chemistry)	<p>CO-1. To learn about crystals; Lattice, space lattice, unit cell, crystal planes, Bravais lattice.</p> <p>CO-2. To know the Bragg's law and application of this law in the powder XRD analysis to determine the crystal structure of NaCl and KCl.</p> <p>CO-3. To learn about the statistical thermodynamics to know about the macrostates, microstates and configuration; calculation with harmonic oscillator.</p> <p>CO-4. To explore the idea about Boltzmann distribution, Partition function and Gibbs' paradox.</p> <p>CO-5. To enrich the idea about these special topics like specific heat of solid, 3rd law of thermodynamics, Polymers and dipole moment and polarizability.</p> <p>CO-6. To know about the computer programming based on numerical methods to run some chemistry formulation.</p>
DSE-2: Analytical methods in chemistry	<p>CO-1: To learn Sampling of any analyte and evaluation of analytical data.</p> <p>CO-2: To learn fundamental laws of spectroscopy and application of different spectrometers.</p> <p>CO-3: To learn qualitative and quantitative analysis of samples through thermogravimetry.</p> <p>CO-4: To learn about basic principles and applications of pH metric, potentiometric and conductometric titrations.</p> <p>CO-5: To learn different types of Separation techniques and their applications in chemical analysis.</p> <p>CO-6: To learn the application of different types of Separation techniques in real field of chemistry.</p>

### Semester-VI (Hons.)

Course	Outcomes After completion of these courses student should be able
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CC-13: Inorganic Chemistry-V	<p>CO-1. To learn about bioinorganic chemistry</p> <p>CO-2. To study about the chemistry of organometallics</p> <p>CO-3. To learn about catalysis by organometallic compounds</p> <p>CO-4. To learn about inorganic reaction mechanism</p> <p>CO-5. To study about the inorganic qualitative analysis of different acid and basic radicals, analysis of inorganic insoluble salt</p>
CC-14: Physical Chemistry-IV	<p>CO-1. To learn about the interaction of electromagnetic radiation with molecules and basic idea about spectroscopy.</p> <p>CO-2. To know about the detail idea about microwave, IR, Raman and NMR spectroscopy for the practical applicability in the various analysis field.</p> <p>CO-3. To learn about the UV-Vis spectroscopy, photochemistry, electronic energy levels and different photochemical aspects like Rate of Photochemical processes, chemiluminescence etc.</p> <p>CO-4. To enrich the idea about surface phenomenon, adsorption, BET theorem, surface catalysis.</p> <p>CO-5. To know about the chemistry of colloids: Lyophobic and lyophilic sols, origin of charge and stability of lyophobic colloids, coagulation and Schultz-Hardy rule, Zeta potential etc.</p> <p>CO-6. To enrich the practical applicability about the surface tension of a liquid using Stalagmometer, determination of CMC verification of Beer and Lambert's law and pH of unknown buffer.</p>
DSE-3: Green chemistry or polymer chemistry	<p>CO-1. To learn about different schemes of classification of polymers and polymer nomenclature.</p> <p>CO-2. To know the functionality and its importance, Kinetics of Polymerization and determination of molecular weight of polymers.</p> <p>CO-3. To learn about the glass transition temperature (T<sub>g</sub>) and determination of T<sub>g</sub>.</p> <p>CO-4. To explore the idea about the preparation, structure, properties and application of some polymers like polyolefins, polystyrene and styrene copolymers.</p>

	CO-5. To enrich the practical applicability about the polymer Synthesis, characterisation like nylon 66/6, novalac resin/ resold resin etc.
DSE-4: Inorganic materials of industrial importance	CO-1: To learn the Manufacturing, processing and properties of different types of glasses, ceramics and cements and their application in different field. CO-2: To learn the Manufacturing, processing and properties of different types of fertilizers and their applications. CO-3: To learn about the different types of surface coating materials, their compositions, properties and functioning. CO-4: To learn about basic principles, mechanism and applications of different types of batteries, Fuel cells and Solar cell. CO-5: To learn preparation and processing of different alloys from the metals. CO-6: To learn the preparation, properties and industrial application of different type of catalysts.

**Part-I (H) (1+1+1)**

Course	Outcomes After completion of these courses students should be able
Paper-I (Inorganic Chemistry)	CO-1. To learn about atomic structure and periodic properties of elements CO-2. To learn chemical bonding and structures of covalent compounds CO-3. To learn about acid base reactions CO-4. To study redox reactions CO-5. To study coordination chemistry

Paper-II (Organic Chemistry)	<p>CO1. To learn about nomenclature of organic molecules</p> <p>CO-2. To learn about structures and properties of aliphatic, aromatic compounds</p> <p>CO-3. To learn about the introduction to organic reactions</p> <p>CO-4. To know about the reactive intermediates</p> <p>CO-5. To study about stereochemistry</p> <p>CO-6. To study about aliphatic nucleophilic substitution reactions</p> <p>CO-7. To know about elimination reactions</p>
Paper-III Physical Chemistry	<p>CO-1. To learn about kinetic theory of gas</p> <p>CO-2. To learn about basic thermodynamics</p> <p>CO-3. To learn about detailed thermodynamics and different types of expression</p> <p>CO-4. To study chemical kinetics</p>
Paper-IV Organic Chemistry Practical	<p>CO-1. To study about qualitative analysis of organic samples</p> <p>CO-2. To investigate different types of organic preparation</p>

### **Part-II (H)**

Course	Outcomes After completion of these courses students should be able
Paper-V (Inorganic Chemistry)	<p>CO-1. To learn about VBT and CFT, magnetic, colour properties of coordination compounds</p> <p>CO-2. To learn about the chemistry of normal, inert gases, transition metal and lanthanoids and actinoids</p>



Paper-VI (Organic Chemistry)	CO1. To learn about stereochemistry of organic compounds CO-2. To learn about electrophilic and radiacal addition CO-3. To learn about nucleophilic addition of carbonyl group CO-4. To know about the molecular rearrangement CO-5. To study about reagents in organic synthesis CO-6. To study about named reactions CO-7. To know about alicyclic compounds CO-8. To understand about synthesis of organic compounds CO-9. To investigate about the aromatic electrophilic substitution CO-10. To learn about aromatic nucleophilic substitution reactions
Paper-VII: Physical Chemistry	CO-1. To learn about thermodynamics and equilibrium CO-2. To learn about phase equilibrium and colligative properties CO-3. To learn about chemical kinetics CO-4. To study about properties of fluids CO-5. To know about macromolecules
Paper-VIII: Inorganic Chemistry Practical	CO-1. To study qualitative analysis of inorganic samples CO-2. To investigate different types of inorganic preparation

**Part-III(H)**

Course	Outcomes After completion of these courses students should be able
Paper-IX (Inorganic Chemistry)	CO-1. To learn about the chemistry of inorganic solids CO-2. To learn about inorganic reaction mechanism CO-3. To learn about the use of metal ions in living system CO-4. To understand organometallic compounds CO-5. To learn about the synthesis, structure and bonding of carbonyl, nitrosyl and organo compounds CO-6. To learn about nano and supramolecular chemistry CO-7. To learn about nuclear and radioanalytical chemistry CO-8. To learn about statistical methods in analytical chemistry CO-9. To know about different types of volumetric analysis, titrations, electroanalytical analysis and spectrophotometric analysis CO-10. To know about methodologies in separation chemistry
Paper-X(Organic Chemistry)	CO1. To learn about chemistry of dyes CO-2. To learn about medicinal chemistry CO-3. To learn about heterocyclic compounds CO-4. To know about the amino acids and proteins CO-5. To study about carbohydrates CO-6. To study about alkaloids and terpenoids CO-7. To know about synthetic methodologies CO-8. To understand about pericyclic reactions CO-9. To investigate about the spectral features of organic compounds CO-10. To learn about nucleic acids CO-11. To learn about green chemistry
Paper-XI Physical Chemistry	CO-1. To learn about conductive properties of electrolytic solutions CO-2. To learn about electrochemical cell CO-3. To learn about properties of solids and

	<p>crystallography</p> <p>CO-4. To study about surface chemistry and adsorption</p> <p>CO-5. To know about colloids</p> <p>CO-6. To learn about electrical properties of molecules</p> <p>CO-7. Learn about symmetry elements and group theory</p> <p>CO-8. To learn about application of quantum theory to chemical systems</p> <p>CO-9. To learn theoretical background of photochemical features and spectral features of elements and compounds</p> <p>CO-9. To learn about statistical thermodynamics</p>
Paper-XII Inorganic, Analytical and Physical Chemistry Practical	<p>CO-1. To study quantitative analysis of inorganic mixtures by redox and complexometric methods</p> <p>CO-2. To investigate titrimetric and colorimetric analysis</p> <p>CO-3. To learn about various physical and chemical properties, to study kinetics of chemical reactions and conductometric and potentiometric titration</p>

### Semester-I (General and Generic)

Course	Outcomes After completion of these courses students should be able
GE-1	<p>CO-1. To learn about extranuclear structures of atoms</p> <p>CO-2. To learn chemical periodicity</p> <p>CO-3. To learn about acid base reactions, redox reactions and precipitation reactions</p> <p>CO-4. To learn redox reactions</p> <p>CO-5. To learn about fundamental features of organic chemistry</p> <p>CO-6. To learn about stereochemistry</p> <p>CO-7. To study about nucleophilic substitution and elimination reactions</p> <p>CO-8. To learn fundamentals features of alkanes, alkenes and alkynes</p>

	CO-9. To investigate redox titrations and qualitative analysis of solid organic compounds
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### **Semester-II (General and Generic)**

Course	Outcomes After completion of these courses students should be able
GE-2 /CC-1B	CO-1. To learn about features of gaseous states CO-2. To learn properties of liquids CO-3. To learn about properties of solids CO-4. To learn kinetics of chemical reactions CO-5. To learn about chemical bonding and molecular structures CO-6. To learn about comparative study of p-block elements CO-7. To study about determination of physical and chemical parameters experimentally CO-8. To learn qualitative semimicro inorganic analysis

### **Semester-III (General)**

Course	Outcomes After completion of these courses students should be able
GE-3 /CC-1C	CO-1. To learn about chemical thermodynamics and its application CO-2. To learn equilibrium for chemical reactions CO-3. To learn about equilibrium in ionic solutions CO-4. To learn aromatic hydrocarbon CO-5. To learn about organometallic compounds CO-6. To learn about aryl halides CO-7. To study about alcohols, phenols, ethers and carbonyl compounds CO-8. To learn determination of pH of various solutions CO-9. To identify pure organic compounds

SEC-1	CO-1. To learn chemical features of carbohydrates, proteins, nucleic acids and enzymes CO-2. To learn biochemical features of blood and urine
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**Semester-IV (General)**

Course	Outcomes After completion of these courses students should be able
GE-4 /CC-1D	CO-1. To learn about the chemical features of solutions CO-2. To learn equilibrium between phases CO-3. To learn about conductive properties of solutions CO-4. To learn electrochemical cells CO-5. To learn about methodologies for chemical analysis CO-6. To learn about environmental chemistry CO-7. To study about distribution law, conductometric titration and potentiometric titrations experimentally CO-8. To learn determination of hardness of water, strength of hydrogen peroxide, solubility product, pH and rate constant
SEC-2	CO-1. To learn the features of pharmaceuticals chemistry

### Semester-V (General)

Course	Outcomes After completion of these courses students should be able
DSE-1A: Transition metal & co-ordination chemistry, Analytical and Industrial chemistry	CO-1: To learn electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of transition elements, Lanthanoids and Actinoids. CO-2: To learn about the principle, structural and Stereoisomerism in complexes of coordination chemistry. CO-3: To learn about the Crystal Field Theory (CFSE for $O_h$ and $T_d$ complexes and distortion effects) CO-4: To learn Error Analysis and its computer applications. CO-5: To learn the Manufacturing, processing and properties of different types of glasses, ceramics, fuels and cements and their application in different field. CO-6: To learn Gravimetric and Complexometric estimation of different metals ions.
SEC-3: Basics & Application of Computer in Chemistry	CO-1. To know about the computer programming based on numerical methods to run some chemistry formulation. CO-2. To learn about Uncertainty in measurement and fundamentals of mathematical functions. CO-3. To explore about bits, bytes, binary and ASCII formats, arithmetic expressions. CO-4. To gather the idea about simple programs using these concepts. Statistical analysis and BASIC programs for curve fitting.

### Semester-VI (General)

Course	Outcomes After completion of these courses students should be able
DSE-1B: Functional group organic chemistry and industrial chemistry	CO-1: To learn preparation (with reaction mechanism) of carboxylic acids and their derivatives. CO-2: To learn preparation (with reaction mechanism) of amines, diazonium salts and nitro-compounds.

	<p>CO-3: To learn preparation, structures and reactions (with mechanism) of Amino acids and Carbohydrates.</p> <p>CO-4: To learn the Manufacturing, processing and properties of different types of polymers, paints, drugs, detergents, dyes and food additives and their application in different fields.</p> <p>CO-5: To learn identification of different organic compounds.</p> <p>CO-6: To learn estimation of saponification value of oil/fat and estimation of acetic acid in commercial vinegar.</p>
SEC-4: Polymer Chemistry	<p>CO-1. To learn about different schemes of classification of polymers and polymer nomenclature.</p> <p>CO-2. To know the functionality and its importance, Kinetics of Polymerization and determination of molecular weight of polymers.</p> <p>CO-3. To explore the idea about the preparation, structure, properties and application of some polymers like polyolefins, polystyrene and styrene copolymers.</p> <p>CO-4. Kinetics of polymerisation</p>

### **Part-I (General) (1+1+1)**

Course	Outcomes After completion of these courses students should be able
Paper-I	<p>CO-1. To learn about atomic structures</p> <p>CO-2. To learn radioactivity</p> <p>CO-3. To learn about periodicity</p> <p>CO-4. To learn about bonding and molecular structures</p> <p>CO-5. To learn about redox reactions</p> <p>CO-6. To learn about equilibrium in ionic solutions</p> <p>CO-7. To study about fundamental features of organic chemistry</p> <p>CO-8. To learn basic concept of reaction mechanism</p> <p>CO-9. To learn about chemistry of hydrocarbon, mono and bi functional organic compounds, aromatic compounds and carbohydrates</p> <p>CO-10. To learn about stereochemistry</p>

	CO-11. To learn about organic synthesis.
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**Part-II (General) (1+1+1)**

Course	Outcomes After completion of these courses students should be able
Paper-II	CO-1. To learn about coordination chemistry CO-2. To learn about group chemistry of p-block elements CO-3. To learn about transition metals CO-4. To learn about properties of gases CO-5. To learn about thermodynamics CO-6. To learn about equilibrium for chemical reactions CO-7. To study about equilibrium between phases CO-8. To learn colligative properties CO-9. To learn about properties of liquids and solids CO-10. To learn about conductance of electrolytic solutions CO-11. To learn about electrochemical cell CO-12. To know kinetics of chemical reactions CO-13. To study theoretical features of photochemistry and spectroscopy
Paper-III	CO-1. To learn about inorganic qualitative analysis CO-2. To study qualitative organic analysis

**Part-III (General) (1+1+1)**

Course	Outcomes After completion of these courses studentsshould be able
Paper-IV	CO-1. To learn about theoretical concepts of chemical analysis CO-2. To learn about green chemistry CO-3. To learn about the feature of biochemical



	molecules CO-4. To learn about medicinal chemistry CO-5. To learn about nano chemistry CO-6. To learn about colloids CO-7. To study about chemistry of polymers
Paper-V	CO-1. To learn about inorganic quantitative analysis

### **Programme Outcomes for Chemistry Honours and Generals**

Department of Chemistry	After successful completion of the three year programme in Honours in Chemistry a student should be able to
Programme outcomes	PO-1. Understand, solve and demonstrate major concepts in all disciplines of chemistry PO-2. Think methodically, independently and logically to solve problems and to arrive at a conclusion PO-3. Employ scientific knowledge and critical thinking to design carry out record and analyse the results of chemical experiments PO-4. Introduce and create an awareness of the impact of chemistry on the environment and social development even outside the scientific community PO-5. Investigate and find out the green route for chemical processes for sustainable development PO-6. Inculcate the scientific attitude in the students and the society PO-7. Utilize modern techniques, decent equipments and software programmes related to chemistry

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