B. Sc in Chemistry (Honours)

Program Specific outcome:

POS 1: Students are able to inculcate the fundamental knowledge of Chemistry and may be useful to their day-to-day life.
POS 2: Students will be confident while solving any problem faced by them.
POS 3: Students are developed for observing and analyzing the results of their experiments.
POS 4: Students will understand the role of Chemistry in our environment and society.
POS 5: Students will develop the awareness regarding the issues/ problems facing by the Chemists.
POS 6: Chemistry is the backbone of science. It will correlate the branches of science and technology.
POS 7: Climate change and environment pollution are very concerned globally. This knowledge is inculcated to the students.
POS 8: Overall students will feel the interest of learning chemistry and further they will love the study of different branches of chemistry such as Fashion Chemistry, Industrial Chemistry, Organic Chemistry, Inorganic Chemistry, Physical Chemistry, etc.

Outcome of B. Sc. Programs.

1. To impart Chemistry knowledge to the students
2. To guide and encourage the students to go for higher studies (i.e., M. Sc and Ph. D, etc)
3. To give scientific temperament for undergoing research works.
4. To inculcate the knowledge of Chemistry regarding the designing and synthesis of drugs which are very helpful for the treatment of human diseases.

CH – 101 Semester – I

Section A: Inorganic Chemistry (25 marks; 30 hours)

After completion of Semester – I, the students are able to:

Unit I: Impart knowledge to the students about the Schrodinger Wave equation, electronic configuration and atomic structure.

Unit II: Inculcating the concept of periodic table and applications in predicting and explaining the Chemical behavior of elements.

Unit III: Understand the idea of hybridization and VSEPRT to certain molecules, concept of VBT and MOT and properties of bonds leading to different chemical behavior of molecules.

Unit IV: Impart knowledge of quantitative analysis of like Oxidimetry and reductimetry, iodometry, iodimetry, pH, common in effect, gravimetric analysis, theory washing, error analysis.

Section C: Physical Chemistry (25 marks: 30 hours)

Unit I: Learn in details about the different laws related with gases, root means square velocities and law of equipartition of energy.

Unit II: Inculcate the knowledge of real and ideal gases behaviors, Boyle Temperature, van der Waals constants and law of corresponding states.

Unit III: Understand the physical property of liquids, surface tension, viscosity and their temperature dependence.

Unit IV: Learn in details the system elements, point group, crystal system, Bravais lattices and Bragg's Law.

CH – 101 P Practical

Understand in details the semi-micro analysis four (4) radicals and quantitative analysis (volumetric) of iodometry and dichromatometry (one metal).

CH – 202 Second Semester

Section A: Inorganic Chemistry

Unit – I: Understand theories of acids and bases.

Unit – II: Inculcate the knowledge of oxidation number, redox potentials factors influencing redox potentials.

Unit – III: Learn in details the qualities of different solvents like liquid ammonia, liquid hydrogen fluoride and liquid Sulphur dioxide.

Unit – IV: Understand the diagonal relationship, solvation and complexation tendencies including their function in biosystems.

Section 3 Organic Chemistry

Unit – I: Inculcate the concepts of symmetry elements, enantiomers, diastereomers, degree rules, D and L, R and S, E and Z systems and conformation.

Unit – II: Learn the knowledge of the structure of Benzene, Kekule rule and aromatic substitution and mechanism.

Unit – III: Understand S_N1 and S_N2 reactions and related mechanism, chloform and carbon tetrachloride and relation reactivities of alkyl halides, allyl and aryl halides.

Unit – IV: Learn in details the physical and chemical behaviors of dihydric and trihydric alcohols.

Section C: Physical Chemistry

Unit – I: Understand the concept of miscibility of different liquids, Raoults Law and Henry's law, critical solution temperature, Nernst's distribution law and its limitations.

Unit – II: Inculcate the colligative properties, Clapeyron – Clausius equation and osmotic pressure.

Unit – III: Understand the colloidal solutions, Tyndal effect, Brownian motion, Freundlich and Langmuir absorption isotherm.

Unit – IV: Learn in details the idea of intensive and extensive properties, different systems, zeroth law of thermodynamics, first law in different conditions, Joule-Thomson effect and inversion temperature.

CH – 202 P: Organic Chemistry Practical

Learn in details the knowledge of the determination of melting points of organic compounds, boiling points of organic compounds, mixed melting point of urea-cinnamic acid mixture using its various compositions (1:4. 1:1, 4:1), distillation and crystallization.

Semester III (CH – 303)

Section A: Inorganic Chemistry

Unit – I: Understand the principles of metallurgy and extraction process of Li, K, Be, Sn, Bi, Cr and Mn.

Unit – II: Inculcate the knowledge of diagonal relationships, basic properties of halogens, interhalogen and polyhalogens and application of Si, Ge and Se.

Unit – III: Learn in details the Characteristic properties of d-block elements.

Unit – IV: Learn in details Werner's coordination theory and related information of coordination compounds.

Section B: Organic Chemistry

Unit – I: Understand the mechanism of name reactions like Fries rearrangements, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, and Reimer – Tiemann reaction.

Unit – II: Inculcate the idea of cleavage and autoxidation and expoxides, Zeisel' method and reaction of ether and epoxides with Grignard reagents.

Unit – III: Understand the synthesis of aldehydes and Ketones and mechanisms of name reactions related with carbonyl compounds.

Unit – IV: Inculcate the concept of preparation of nitro compounds and their related reaction, study of amines and their related reactions.

Section C:

Unit – I: Learn in details the calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data and Kirchoff's equation.

Unit – II: Understand the second law of thermodynamics. Carnot cycle and Gibbs-Helmholtz equation.

Unit – III: Inculcate the concept and criteria of thermodynamic equilibrium and thermodynamic derivation of relationship between the various equilibrium constants K_p, K_c and K_x. Le Chatelier principle.

CH – 303 P Practical

Understand the physical Chemistry experiments the determination of surface Tension and viscosity of a given liquid, and pH measurements.

4th Semester CH- 404

Section A: Inorganic Chemistry

Unit – I: Learn in details general properties of Lanthanides and its use.

Unit – II: Learn in details general properties of Actinides and comparisons between lanthanides and actinides.

Unit – III: Inculcate the physical and chemical properties of Noble gases, study of xenon compound and uses of noble gases.

Unit – IV: Understand the different theories of hard and soft acids and bases, hardness and softness of acids and bases and Symbiosis.

Section B: Organic Chemistry

Unit – I: Inculcate the concept of the preparation if carboxylic acids and their related reactions and study of hydroxy acids, malic, tartaric and citric acids.

Unit – II: Understand the mechanism of esterification and hydrolysis of Carboxylic acid and their derivation.

Unit – III: Learn in details the formation of Grignard reagents, their structures and related reactions.

Unit – IV: inculcate the knowledge of natural and synthetic polymers, imparting the elementary idea of fiber making and blended fibers.

Section C: Physical Chemistry

Unit – I: Understand the types catalysts, Enzymes catalysis, acid-base catalysis and theory of catalysis.

Unit – II: Inculcate the concept of different electrolytes, buffer solution, buffer action and roles of buffers in human biological process.

Unit – III: Learn in details the ideal solubility and solubility product and theory of acid-base indicators.

Unit – IV: Understand phase rule and application of phase rule to water, carbon dioxide and Sulphur dioxide.

CH – 404 P

Understand Estimation of hardness of water by using EDTA
Estimation of DMG, estimation of reducing sugar, determination of equivalent weight of organic acids, estimation of protein, saponification value of fat or oil sample and Lambert-Beer's law.

5th Sem
CH-505 Inorganic Chemistry

Unit – I: Inculcate the concepts of radioactive elements and thermonuclear reactions.

Unit – II: Learn in details the comparative studies of s - and p – block elements, study of Portland cement and borazole, solid CO_2 carboneous fuels and properties of Chalcogens.

Unit III: Understand the vertical and horizontal groups relationships of 3d, 4d and 5d elements and role of transition in biology.

Unit – IV: Inculcate in details the idea of alloying and intermetallic compounds.

Unit – V: Learn in details the Fundamental laws of photochemistry, application of UV- visible spectroscopy to conjugate dienes, α, β – unsaturated compounds and inorganic compounds.

Unit – VI: Understand IR Spectroscopy and its application to characterization of groups like C=N, C=O, C=C, COOR, N-H and $CONH_2$.

Unit – VII: Inculcate the knowledge of thermodynamics stability of metal complexes and substitution reaction of square planar complexes.

Unit – VIII: Understand the Environmental segment, photochemical smog, water pollution, solid waste pollution, treatment and disposal.

CH-506 Organic Chemistry

Unit – I: Learn in details the classification and nomenclature of Monosaccharides, configuration of monosaccharides, mutarotation and different carbohydrates.

Unit – II: Inculcate in details the knowledge of the classification structure and stereochemistry of amino acids, classification of protein and denaturation of protein.

Unit – III: Understand Nucleic acids and double helical structure of DNA.

Unit – IV: Learn in details the natural fats, edible and industrial oils and vegetables, iodine value, soaps, synthetic detergents.

Unit – V: Understand thermal and photo chemical reaction involving 4 and 6 π – electrons and corresponding cyclo reversion reaction.

Unit – VII: Learn in details Isolation and synthesis of cholesterol, Estrone and Biosynthesis of steroids.

Unit – VIII: Inculcate the knowledge of isolation of terpenes including the determination of chemical composition structure.

Unit – IX: Understand the extraction and general method of determining structure, isolation and synthesis of nicotine, atrophine and cocaine.

Unit – X: Learn in details the general characteristics and nomenclature of enzyme function.

Section C: Physical Chemistry

Unit – I: Understand Mean, Standard deviation, relative error, graphical and numerical data reduction and regression.
Unit – II: Inculcate the knowledge if Black body radiation, photoelectric effect, Compton effect and de Broglie's relationship.

Unit – III: Learn in details the concept of Quantum mechanical operators of momentum, position, energy and postulates of quantum mechanics.

Unit – IV: Understand the knowledge of Stark- Einstein's laws of photochemical equivalence, quantum yield, phosphorescence, fluorescence, Chemiluminescence and photosensitization.

Unit – V: inculcate the idea of Gibbs-Helmholtz equation, Partial molar quantities, chemical potential of ideal mixture and Third Law of thermodynamics.

Unit – VI: Learn in details the concept of Dulong and Petit's Law, heat capacities and Debye's T^3 Law.

Unit – VII: Inculcate the concept of probability of distribution law of multiplication and addition of probabilities and Sterling approximation.

Unit – VIII: Understand the knowledge of Electromagnetic radiation and elementary idea of different spectroscopic techniques and the information obtainable for each.

Unit – IX: Understand the knowledge of natural and synthetic polymers, number average molecular weight and average molecular weight and special properties of polymers.

Unit – X: Inculcate in details the concept of conductance, transport number, Kohlausch's Law, pH of a salt solution and buffer action.

CH-508 Practical

Understand the experiment of the determination of the equilibrium constants of
a) I_2 in water – Kerosene/ CCl_4
b) $I_2\,(aq) + I^{-} \longrightarrow I_3^{-}\,(aq)$,
c) $Cu^{2+}\,(aq) + nNH_3 \longrightarrow [Cu\,(NH_3)_n]^{2+}$ systems
d) pH metric titration,
e) Critical solution temperature and phase equilibria.

Understand the preparation of inorganic complexes, estimation of two constituents from a binary, mixture (one volumetrically and one gravimetrically) and semimicro analysis of five radicals containing at least one rare element (V,Mo, W, etc.)

CH-608 6th Semester

Section A: Inorganic Chemistry

Unit – I: Learn in details the Theory of coordination bond, crystal Field theory and stability constants.

Unit – II: Learn in details the concept of magnetic behaviors of transition mental complexes and John-Tellar Theorem.

Unit – III: Understand the knowledge of inorganic polymers like phophazene and triphosphazene, Zeolite and molecular sieves.

Unit – IV: Inculcate the ideas of Thermogravimetric and Differential Thermal Analysis and Scanning Calorimetry and their applications.

Unit – V: Understand the knowledge of organometallic compounds and structure of CO, NO, and N_2 compounds.

Unit – VI: Understand the knowledge of essential trace elements in the biological processes and biological role of Na^+, K^+ and Ca^{2+} in the biological systems.

Unit – VII: Learn in details the concepts of Boranes, Borazine and tetrasulphurtetranitride.

Unit – VIII: Inculcate the knowledge of lattice energy, Born-Haber cycle, non-stoichiometric and stoichiometric defects, semiconductors and transistors.

609 Section B: Organic Chemistry

Unit – I: Understand the knowledge of the properties of Thiols, thioethers, sulfonic acids and sulfonamides.

Unit – II: Learn in details the ideas of E1, E2, and E1 cb mechanism and factors affecting the elimination and substitution reactions.

Unit – III: learn in details the concept of the synthesis of ethylmalonate and ethylacetoacetate, alkylation 1, 3-dithianes and Alkylation and acylation of amines.

Unit – IV: Understand the knowledge of molecular pictures and aromatic characteristics of pyrrole, furan, thiophene, pyridine, Bischler-Napieralski synthesis and Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

Unit – V: Inculcate the concept of the synthesis and structure of Drugs and antibiotics like Sulfadrugs, Chloramphenicol.

Unit – VI: Understand the knowledge of the principles and application of Chromatography.

Unit – VII: Learn in details the fragmentation of organic molecular and presentation of mass spectra of 2-methyl pentane and cyclohexane.

Unit – VIII: Understand the knowledge of nuclear magnetic Spectroscopy and application for the structure illustration of Trans-cinnamic acid, 1, 1, 2 – trichloroethane and ethyl bromide.

Unit – IX: Inculcate the ideas of the precepts of electron paramagnetic resonance and epr spectra of $C_6H_6^{\cdot-}$ and $CH_3 – CH – \dot{O} – CH_2 – CH_3$

Unit X: Understand the Principles and application of green chemistry and principles of ultrasound and microwave assisted organic reactions.

CH = 610

Section A: Physical Chemistry

Unit – I: Understand the types of computers, black diagram of a digital computer, algorithm, flowchart and Applications of computer in Chemistry.

Unit – II: Learn in details the Schrodinger wave equation for a free particle moving in one dimensional box and its solutions.
Unit – III: Inculcate in details the concept of Rigid rotor, selection rules, Roman effects and Roman shift.

Unit – IV: Understand the knowledge of symmetry operation, point groups and group multiplication table (C_{2v}, C_{3v})

Unit – V: Inculcate the knowledge of Nernst equation, free energy, equilibrium constants, pH values and standard electrode potentials.

Unit – VI: Learn in details the concept of concentration Cells, potentiometric titrations, precipitation. Debye – Huckel – Onsager theory, activity and activity coefficients.

Unit – VII: Understand the Maxwell- Boltzmann distribution law, partition function and its physical significance.

Unit – VIII: Understand the classification of surfactants which are having hydrophilic and hydrophobic groups and Micelles.

Unit – IX: Inculcate the ideas of collision theory, Lindermann mechanism, steady state approximation, opposing reactions, parallel reactions, consecutive reaction and chain reaction.

Unit – X: learn in details the knowledge of phase equilibria of two component system like Solid-liquid equilibria and solid solutions, freezing mixture and acetone dry ice.

CH – 611 P Organic Chemistry Practical

Section A: Understand the identification of organic compounds containing main functional groups.

Section B: Lean in details the organic preparations which are involving acetylation, benzoylation and Nitration.

Physical Chemistry Practical

Understand the conductometric titration, saponification of ethyl acetate, verification of Lambert-Beer's Law, determination of pK for phenolphthalein and methyl red and study of formation of a complex between ferric and thiocyanate ions.

5th Sem CHEMISTRY (GENERAL)
CH-501
Section – A: Inorganic Chemistry

Unit – I: Inculcate the concepts of radioactive elements and thermonuclear reactions.

Unit – II: Learn in details the comparative studies of s - and p – block elements, study of Portland cement and borazole, solid CO_2 carboneous fuels and properties of Chalcogens.

Unit – III: Inculcate in details the idea of alloying and intermetallic compounds.

Unit – IV: Learn in details the Fundamental laws of photochemistry, application of UV- visible spectroscopy to conjugate dienes, α, β – unsaturated compounds and inorganic compounds. Understand IR Spectroscopy and its application to characterization of groups like C=N, C=O, C=C, COOR, N-H and $CONH_2$.

Unit – V: Understand the Environmental segment, photochemical smog, water pollution, solid waste pollution, treatment and disposal.

Section B: Organic Chemistry

Unit – I: Learn in details the classification and nomenclature of Monosaccharides, configuration of monosaccharides, mutarotation and different carbohydrates.

Unit – II: Inculcate in details the knowledge of the classification structure and stereochemistry of amino acids, classification of protein and denaturation of protein.

Unit – III: Understand thermal and photo chemical reaction involving 4 and 6 π – electrons and corresponding cyclo reversion reaction.

Unit – IV: Understand the extraction and general method of determining structure, isolation and synthesis of nicotine, atrophine and cocaine.

Section C: Physical Chemistry

Unit – I: Learn in details the concept of Quantum mechanical operators of momentum, position, energy and postulates of quantum mechanics.

Unit – II: Understand the knowledge of Stark- Einstein's laws of photochemical equivalence, quantum yield, phosphorescence, fluorescence, Chemiluminescence and photosensitization.

Unit – III: Understand the knowledge of natural and synthetic polymers, number average molecular weight and average molecular weight and special properties of polymers.

Unit – IV: Inculcate in details the concept of conductance, transport number, Kohlausch's Law, pH of a salt solution and buffer action.

A: Organic Experiments

Understand the identification of organic compounds containing main functional groups.

Lean in details the organic preparations which are involving acetylation, benzoylation and Nitration.

B: Physical Experiments

Understand the experiment of the determination of the equilibrium constants of
a) I_2 in water – Kerosene/ CCl_4
b) I_2 (aq) + I^- ⟶ I_3^- (aq),
c) Cu^{2+} (aq) + nNH_3 ⟶ $[Cu(NH_3)_n]^{2+}$ systems
d) pH metric titration,
e) Critical solution temperature and phase equilibria.

Understand the preparation of inorganic complexes, estimation of two constituents from a binary, mixture (one volumetrically and one gravimetrically) and semimicro analysis of five radicals containing at least one rare element (V,Mo, W, etc.)

601 – Chemistry (GENERAL) 6th Semester

Section A: Inorganic Chemistry

Unit – I: Learn in details the Theory of coordination bond, crystal Field theory and stability constants.

Unit – II: Understand the knowledge of inorganic polymers like phophazene and triphosphazene, Zeolite and molecular sieves.

Unit – III: Understand the knowledge of essential trace elements in the biological processes and biological role of Na^+, K^+ and Ca^{2+} in the biological systems.

Unit – IV: Understand the knowledge of organometallic compounds and structure of CO, NO, and N_2 compounds.

Unit – V: Understand the principles of metallurgy and extraction process of Li, K, Be, Sn, Bi, Cr and Mn.

Section B: Organic Chemistry

Unit – I: Learn in details the ideas of E1, E2, and E1 cb mechanism and factors affecting the elimination and substitution reactions.

Unit – II: learn in details the concept of the synthesis of ethylmalonate and ethylacetoacetate, alkylation 1, 3-dithianes and Alkylation and acylation of amines.

Unit – III: Understand the knowledge of molecular pictures and aromatic characteristics of pyrrole, furan, thiophene, pyridine, Bischler-Napieralski synthesis and Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

Unit – IV: Inculcate the concept of the synthesis and structure of Drugs and antibiotics like Sulfadrugs, Chloramphenicol.

Section C: Physical Chemistry

Unit – I: Learn in details the Schrodinger wave equation for a free particle moving in one dimensional box and its solutions.
Unit – II: Inculcate in details the concept of Rigid rotor, selection rules, Roman effects and Roman shift.

Unit – III: Understand the classification of surfactants which are having hydrophilic and hydrophobic groups and Micelles.

Unit – IV: Understand the knowledge of symmetry operation, point groups and group multiplication table (C_{2v}, C_{3v})

A: Organic Experiments

Understand the identification of organic compounds containing main functional groups.

Lean in details the organic preparations which are involving acetylation, benzoylation and Nitration.

B: Inorganic Experiments

Understand the experiment of the determination of the equilibrium constants of
a) I_2 in water – Kerosene/ CCl_4
b) $I_2(aq) + I^- \longrightarrow I_3^-(aq)$,
c) $Cu^{2+}(aq) + nNH_3 \longrightarrow [Cu(NH_3)_n]^{2+}$ systems
d) pH metric titration,
e) Critical solution temperature and phase equilibria.

Understand the preparation of inorganic complexes, estimation of two constituents from a binary, mixture (one volumetrically and one gravimetrically) and semimicro analysis of five radicals containing at least one rare element (V,Mo, W, etc.)