

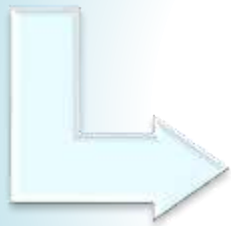


Maratha Vidya Prasarak Samaj's
Karmaveer Shantarambapu Kondaji Wavare
Arts, Science and Commerce College, CIDCO, Nashik
Uttamnagar, Nashik- 422 008 (Maharashtra)

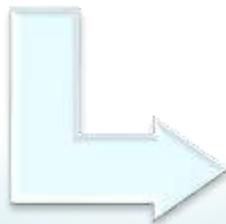
Affiliated to Savitribai Phule Pune University Id. No. PU/NS/ASC/047/1993
AISHE C-42086 NAAC Re-accredited 'A' Grade (III Cycle 2017-22, CGPA 3.20)
Best College Award of Savitribai Phule Pune University Pune in 2009-10 and 2021-22

**Programme
Outcomes (PO's)**

Internal Quality Assurance Cell



**Programme
Specific Outcomes
(PSO's)**



**Course Outcomes
(CO's)**

Syllabus: 2013 Pattern





Maratha Vidya Prasarak Samaj's
KARMAVEER SHANTARAMBAPU KONDAJI WAVARE
ARTS, SCIENCE AND COMMERCE COLLEGE, CIDCO

Uttamnagar, Nashik- 422 008 (Maharashtra)

Principal

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Prof. (Dr) S. K. Kushare
 M.Sc., Ph. D.

Programme Outcome (PO's), Programme Specific Outcome (PSO's), Course Outcome (CO's)

Department: Chemistry

Syllabus: 2013 Pattern

Sr. No.	Name of the Programme	Year of introduction of programme	Duration of introduction of Programme
1	B.Sc.Chemistry	1993	3 Years

Programme Specific Outcome (B.Sc Chemistry)

Sr. No.	Programme Specific Outcome (B.Sc Chemistry)
PSO 1	The chemistry graduates are able to apply knowledge of the fundamental concepts of chemistry and applied chemistry through theory and practical.
PSO 2	B.Sc. chemistry students are able to understand the scope, methodology and application of modern chemistry.
PSO 3	B.Sc. chemistry student able to Plan and conduct scientific experiments and record the results of such experiments.
PSO 4	B.Sc. chemistry student are acquaint with safety of chemicals, transfer, and measurement of chemicals, preparation of solutions, and using physical properties to identify compounds and chemical reactions
PSO 5	B.Sc. chemistry student are able to use modern chemical tools, models, charts and various useful equipments.
PSO 6	B.Sc. chemistry student able to explain the nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.
PSO 7	B.Sc. chemistry student describe how chemistry is useful to solve social, economic and environmental problem and issues facing our society in energy, medicine and health.

Course Outcome (B.Sc Chemistry)

F.Y.B.Sc Chemistry Course Outcomes

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
F.Y.B.Sc. Term-I	PAPER - I:	PHYSICAL & INORGANIC CHEMISTRY	CO 1: makes understanding of behavior of gases, ideal gas as a model system and its extension to real gases. The dependence of physical state on pressure, volume and temperature is being realized. CO 2: The existence of liquid state, comparison of its properties with other states to be perceived. Liquid crystal are essentials in all common and research devices and

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			instruments hence they are introduced briefly
			CO 3: Student should be able to solve problems regarding van der Waal's and Critical constant and regarding P-V-T relations Understanding dynamic nature of surface and its applications in catalysis.
			CO 4: Students should know, Mole concept, GMV relationship, Student should be able to solve problems based on GMV relationship. Normality, Molarity, Normal solution, Molar solution, equivalent weight, ppm, %w/v,%v/v& related problems.
			CO 5: Standard solution, primary & secondary standard substances, standardization of solution & related problems.
			CO 6: Understand the concept of oxidation & reduction, oxidizing agent, reducing agent, redox reaction, oxidation number, Balance the equation by ion electron method & oxidation number method.
			CO 7: Calculation of Equivalent weight of oxidant & reductant
	PAPER - I		CO 1: Basic principle of overlapping of atomic orbital with specific shapes and sizes
			CO 2: Fundamental concepts of theories of overlapping of atomic orbitals
			CO 3: Concept of hybridization and differentiation with overlap
			CO 5: Concept of different types valence shell electron pairs and their contribution in bonding
			CO 6: Application of non-bonded lone pairs in shape of molecule
			CO 7: Basic understanding of geometry and effect of lone pairs with examples.
	PAPER - II:	ORGANIC & INORGANIC CHEMISTRY	CO 1: Skeleton of long form of periodic table
			CO 2: Quantum numbers, Shells, sub-shells, types of orbital and their shapes, Aufbau, Paulin's exclusion principle and Hunds rule, Block, group, periodic law and periodicity
			CO 3: Name, symbol, electronic configuration, trends and properties
			CO 4: Crown ether and cryptans.
			CO 5: Separation of s-block elements with crown ethers, Compounds of s-block elements:

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to		
			oxides, hydroxides, peroxides and superoxides		
F.Y.B.Sc. Term II			CO 1: Structure, nomenclature, preparation and reactions of organic compounds, The characteristic reactions of each functional group which can be used to identify and distinguish that compound from other compounds		
			CO 2: Predict the conversion of one functional group into other functional group involving one or more number of steps.		
			CO 3: Conversion of the given compound into other compound containing more or less number of carbon atoms.		
			CO 4: Prediction of possible products when reactants are given. In case there are more than one possible products, identify the major and minor products.		
			CO 5: Concept of isomerism, types of isomers and representation of organic molecules, Conformational isomerism in alkanes with energy profile diagram. Concept of geometrical isomerism with E/Z nomenclature. Understanding of optical activity, isomer number, tetrahedral carbon atom, concept of chirality, enantiomerism, R/S nomenclature for single chiral centre.		
			CO 6: write electronic configuration of any element		
			CO 7: give reasons for anomalous behavior of first element of IIIA to VII A groups with other elements in the same group.		
			CO 8: know the exact position p-block elements in the long form of the periodic table. Basic compounds of boron, aluminum, silicon		
			Paper - III	Chemistry Practical Course	CO 1: Understand importance and scope of Analytical chemistry
					CO 2: Prepare lyophobic and lyophilic sols.
					CO 3: know the role of emulsifying agents in stabilizing the emulsion of different oils
					CO 4: determine the gas constant R in different units by eudiometer method.
					CO 5: determine relative viscosity of given organic liquids by viscometer.
					CO 6: determine DH and DS for the following chemical reactions
CO 7: Determination of hardness of water ,					

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			Carry out Inorganic qualitative analyses CO 8: determine amount of acetic acid in commercial vinegar CO 9: Analyse organic compound qualitatively.
S.Y.B.Sc.	CH-211	Physical and Analytical Chemistry	CO 1: Identify chiral center in the given organic compounds
			CO 2: Concept of distribution of solute amongst pair of immiscible solvents.
			CO 3: Distribution law and its thermodynamic proof
			CO 4: Distribution law and nature of solute in solution state.
			CO 5: Chemical analysis and its applications
			CO 6: Sampling, Common techniques, Instrumental methods and other techniques, Choice of method.
			CO 7: Meaning of error and terms related to expression & estimation of errors, Methods of expressing accuracy and precision, Classification of errors, Significant figures and computations
			CO 8: Basic principles in qualitative analysis, Meaning of common ion effect, Role of common ion effect and solubility p, Group reagent and precipitating agents Interfering anions and its removal, Separation for basic radicals.
			CO 9: Classification of compounds with different functional groups, Characteristic tests for different functional groups, Quantitative analysis of C, H
			CH-212
CO 2: Define Erythro, threo, meso, diastereoisomers with suitable examples			
CO 3: Explain the stability of cyclohexanes, Draw structure of conformations of mono- & disubstituted cyclohexanes			
CO 4: Define and classify heterocyclic compounds, Use Huckel rule to predict aromaticity, Write and complete various reactions of heterocyclic compounds			
CO 5: to differentiate between ore and minerals, differentiate between calcination and roasting and smelting			

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			CO 6: know the different methods for separation of gangue or matrix from metallic compounds, To know the terms smelting, flux.
			CO7: know physico-chemical principles involved in electrometallurgy. understand electrolysis of alumina and its refining, explain the uses of Aluminum and its alloys.
			CO 8: know different reactions in the blast furnace
			CO 9: explain the basic principles of different methods for preparation of steel.
			CO 10: Define ,Types, Mechanism, Factors affecting corrosion and Methods of prevention of metal from corrosion.
			CO 11: Meaning of passivity, Different theories of passivity, Galvanising, Tinning, Electroplating from corrosion.
	CH-221	Physical and Analytical Chemistry	CO 1: Free energy concepts, types and its variation, Free energy change for ideal gases
			CO 2: Gibb's Helmholtz equations and its properties & significance
			CO 3: van't Hoff reaction isotherm and thermodynamic equilibrium constants
			CO 4: Ideal and non ideal solutions and laws governing these solutions.
			CO 5: Interpretation of vapor pressure–composition diagram.
			CO 6: Interpretation of temperature composition diagram.
			CO 7: Distillation from temperature – composition diagram, Azeotropes, Partially immiscible liquids.
			CO 8: Meaning of equivalent weight, molecular weight, normality, molality, primary and secondary standards. Preparation of standard solution, Calibrate various apparatus, Types instrumental and non instrumental analysis
			CO 9: Indicators, mixed and universal indicators, Know neutralization curves for various acid base titration
			CO 10: Know principle of complexometric precipitation and redox titrations, difference between iodometry and

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			iodimetry, Determine the amount of halides separately and in presence of each other.
S.Y.B.Sc Sem II.	CH-222	Organic and Inorganic Chemistry	CO 1: Concept of different reagents used in the one type of conversion, Reagent based mechanisms, Suggest synthetic route for preparation of various heterocyclic compounds, Write and complete various reactions of heterocyclic compounds, different biomolecules.
			CO 2: role of biochemistry in the day to day life, Classify carbohydrates giving suitable examples.
			CO 3: Explain stereoisomerism in monosaccharide, Distinguish between diastereomers and epimers
			CO 4: Write cyclic structure of glucose, maltose, lactose, cellobiose and sucrose, maltose, lactose, cellobiose and sucrose
			CO 5: Classify the naturally occurring amino acids, Explains the amphoteric nature of amino acids, Classify proteins.
			CO 6: understand M-C bond and to define organometallic compounds, know position of d-block elements in periodic table.
			CO 7: know the general electronic configuration & electronic configuration of elements, know trends in periodic properties.
			CO 8: know methods of synthesis of binary metal carbonyls, understand the 18 electron rule, understand the catalytic properties of binary metal carbonyls
			CO 9: define acids and bases according to Arrhenius theory Lowery- Bronsted concept, Lewis concept, define the conjugate acid and base pairs, demonstrate the trends in the strength of hydracids, oxyacids, define hard and soft acids,
			CO 10: explain the properties of a solvent that determines their utility
			CO 11: know toxic chemical in the environment, know the impact of toxic chemicals on enzyme. explain biological methylation
	CH – 223	Practical Course in Chemistry	CO1: Verify theoretical principles experimentally, Interpret the experimental data, Improve analytical skills, Correlate the theory and experiments and understand their importance
			CO 2: Acquire skill of crystallisation, record correct m. p. / b. p
			CO 3: Perform the complete chemical analysis of the given organic compound

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			CO 4: Perform the given organic preparation according to the given procedure
			CO 5: Perform all the activities in the laboratory with neatness and cleanness
			CO 6: Interpret the experimental data.
T.Y.B.Sc Sem I	CH-331	Semester-III Physical Chemistry	CO 1: Expression for rate constant k for third order reaction, Examples of third order reaction
			CO 2: Experimental determination of order of reaction by Integrated rate equation method,
			CO 3: Explain the term energy of activation, Graphical evaluation of energy of activation
			CO 4: Ohm's law and electrical units such as coulomb, Ampere, Ohm and Volt, Meaning of specific resistance, specific conductance, cell constant and their units.
			CO 5: Cell constant, its theoretical and experimental determination, Experimental determination of conductance
			CO 6: Variation of specific and equivalent conductance of strong and weak electrolyte with dilution
			CO 7: Kohlrausch's law of independent migration of ions and its applications such equivalent conductance of weak electrolyte at zero conc., degree of dissociation,
			CO 8: Hittorf's rule and Experimental determination of transport number, Debye-Huckel-Onsager Interionic Attraction theory
			CO 9: Determine Activity and activity coefficient of strong electrolyte
			CO 10: Understand the term additive and constitutive properties
			CO 11: Understand the term specific volume, molar volume and molar refraction
			CO 12: Understand the meaning of electrical polarization of molecule, Dipole moment and its application
			CO 13: Know Rotational / Microwave spectroscopy, Vibrational Spectra, Raman Spectroscopy
			CO 14: Meaning and Types of equilibrium such as true or static, metastable and Unstable equilibrium
	CO 15: Derivation of phase rule, Explanation of water, sulphur and two component system.		
	CH-341	Semester-IV	CO 1: What is mean by Electrochemical cell, Conventions used to represent

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
		Physical Chemistry	<p>electrochemical cell. . Construction, representation, working and limitation of Standard hydrogen Electrode, Calomel and Silver –Silver Chloride electrode, Weston Standard Cell, Measurement of EMF of electrochemical cell</p> <p>CO 2: Nernst Equation for theoretical determination of EMF</p> <p>CO 3: Thermodynamics and EMF: Relation of EMF with ΔG, ΔG°, ΔH, ΔS and equilibrium constant K of the cell reaction .</p> <p>CO 4: Classification of electrochemical cell , Electrode and electrolytic concentration cell,</p> <p>CO 5: Application of EMF measurement such as pH determination, Determination of solubility and solubility product.</p> <p>CO 6: Potentiometric titrations: Weak acid against strong base, Titration of polybasic acids, Precipitation and Redox titrations.</p> <p>CO 7: The atom its nucleus and outer sphere, Classification of nuclides with isotope, isobar, isotone and isomers</p> <p>CO 8: Explanation of stability of nucleus through neutron to proton ratio, odd and even nature of proton and neutron, Mean binding energy.</p> <p>CO 9: Explanation of binding energy curve, Measurement of radioactivity by G.M. and proportional counter,</p> <p>CO 10: Age determination- by Carbon-14 dating, Medical applications-Assess the volume of blood in patients body, Goitre.</p> <p>CO 11: Distinguish between crystalline and amorphous solids, anisotropic and isotropic solid</p> <p>CO 12: Explain the term crystallography and laws of crystallography, Weiss and Millers Indices, Crystal system and their characteristics, type of simple, body centred and face centred cubic crystals</p> <p>CO 13: Concept of quantization, Atomic spectra, Uncertainty principle and its physical significance, time independent Schrodinger wave equation., Wave function and its Interpretation, Particle in a box</p>
	CH-347	Physical chemistry Practicals	CO1: Verify theoretical principles experimentally, Interpret the experimental data, Improve analytical skills, Correlate the theory and experiments and understand their importance.

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			CO 2: Acquire skill of handling, standardization, application of conductometer. Potentiometer, pH meter, Refractometer, colorimeter
			CO 3: Chemical Kinetics for determination First order, second order
			CO 4: Study the effect of concentration of the reactants on the rate of hydrolysis of an ester
			CO 5: Determine the energy of activation of the reaction between potassium iodide and potassium persulphate, determine the molecular weight of a high polymer, test the validity of Freundlich / Langmuir isotherm, determine the molecular refractivity
			CO 6: Colorimetry Determination of λ_{max} and concentration of unknown solution. To titrate Cu^{2+} ions with EDTA photometrically. To determine the indicator constant of methyl red indicator.
	CH-332	Semester-III Inorganic Chemistry	CO 1: Know the theories of covalent bond formation, Understand the need of concept of MOT, Understand and show the formation of bonding and antibonding MO's, Draw the MO energy level diagrams for homonuclear diatomic molecules, Draw the shapes of molecular orbitals, Understand the formation of molecule and construct MO energy level diagrams.
			CO 2: Know the meaning of various terms involved in coordination chemistry, Understand the chelating agents, chelate and stability of chelates and complexes, give the IUPAC name the coordination compound. Know the application of co-ordination compounds in biology and chemistry, define and explain isomerism in complexes
			CO 3: explain structure and magnetic behaviour of the complexes
			CO 4: Explain electroneutrality principle and different types of pi bonding
			CO 5: draw crystal field splitting diagrams of d orbital of metal ion in octahedral, tetrahedral, square planer of tetragonal ligand field
			CO 6: find high spin and low spin complexes, explain d-d transitions and colour of the complexes. Explain MOT of Octahedral complexes.
	CH-342	Semester-IV Course: Inorganic	CO 1: The meaning of term f-block elements, Inner transition elements, lanthanides, actinides, Electronic

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
		Chemistry	configuration, Oxidation states, Separation and Use of lanthanide elements in different industries.
			CO2: The meaning of metal & semiconductor, The difference between metal, semiconductor and insulator.
			CO 3: Explain the electrical conductivity of metals with respect to valence electrons. n and p type of semiconductors, Meaning of super conductors and their structure.
			CO 4: Know the nature and crystal structures of solids. Know the effect of radius ratio in determining the crystal structure, Be able to solve simple problems based on Pauling's univalent radii and crystal radii, Be able to differentiate between the defects
			CO 5: Define the homogeneous catalysis, Give examples of homogeneous catalysts. Understand the essential properties of homogeneous catalysts-Give the catalytic reactions, Give the brief account of homogeneous catalysis.
			CO 6: Define the heterogeneous catalyst and heterogeneous catalysis, Understand the essential properties of heterogeneous catalysts. Give the catalytic reactions for oxidation, reduction and cyclization processes.
			CO7: Identify the biological role of inorganic ions & compounds, Give the classification of metals as enzymatic and non-enzymatic.
	CH-348	Inorganic Chemistry Practicals	CO1: Verify theoretical principles experimentally, Correlate the theory and experiments and understand their importance.
			CO 2: Interpret the experimental data, Improve analytical skills.
			CO 3: Correlate the theory and experiments and understand their importance.
			CO 4: Different methods of estimation, preparation, and separation of analyte.
F.Y.B.Sc Sem III and IV	CH-333	Semester III Course: Organic Chemistry	CO 1: Definition and types of organic acid and base. The pka and pkb concepts, Effect of temperature on pka/pkb, Comparison between strengths of acids/bases, What is acid-base catalysis.
			CO 2: draw different types of disubstituted cyclohexane in Chair form, distinguish between geometrical and optical isomerism, Stability, energy calculations with potential energy diagram and optical activity of these conformers..
			CO 3: Definition and type of nucleophiles and leaving groups, Different types of nucleophilic substitution reactions,

			<p>Definition of inversion and racemization, The kinetics, mechanism & stereochemistry of S_N1, S_N2 and S_Ni reactions.</p> <p>CO 4: Different types of carbon-carbon unsaturated compounds, Orientation / rules in addition reactions, The structure of carbonyl group, Reactivity concept, and Correct mechanism of addition reactions using different reagents.</p> <p>CO 5: Definition and types of elimination reactions, Different types of bases and leaving groups, The evidences, mechanism & stereochemical aspects of these reactions. $E1$, $E2$ or $E1cB$ mechanism.</p> <p>CO 6: Definition and types of aromatic substitution reactions, Classification of directing groups, The evidences, reactivity and mechanism of these reactions.</p>
	CH-343	Semester IV Course: Organic Chemistry	<p>CO 1: Spectroscopy, Different regions of electromagnetic radiations, Various terms used in spectroscopy, Brief idea about the advantages of spectroscopic methods.</p> <p>CO 2: Meaning of terms Disconnection, Synthons, Synthetic equivalence, Functional Group Interconversion, Target Molecule and synthesis of some molecules by retrosynthesis approach.</p> <p>CO 3: rearrangement reaction, Different types of intermediate in rearrangement reactions, writes mechanism of some named rearrangement reactions.</p> <p>CO 4: What is UV, IR and NMR Spectroscopy, Different types of electronic excitations, vibrations, Applications of UV IR and NMR Spectroscopy.</p> <p>CO 5: terpenoids and alkaloids, methods of isolation/extraction and Synthesis of natural products. determine the structure compounds by chemical methods.</p>
	CH-349	Organic Chemistry Practical	<p>CO 1: Type, Separation of mixture, Preliminary tests, Physical constants, Elements and Functional groups only. The purified samples of the separated components should be submitted. Separation and qualitative analysis of the binary Mixtures.</p> <p>CO 2: prepare compound, use of double burette method for titration.</p> <p>CO 3: Monitoring of the reaction and purification and able to record physical constant, uses TLC with proper selection of the solvent system.</p>
	CH-334	Semester-III Course: Analytical Chemistry	<p>CO 1: Principles of common ion effect and solubility product, Factors affecting on solubility of precipitation, Phenomenon of super saturation and precipitation formation, Meaning of co-precipitation and</p>

			<p>post precipitation, Choice of liquid for washing the precipitate, Precautions during filtration, drying and ignition of precipitate, understanding of electrogravimetric principle and solve numerical problems.</p> <p>CO 2: Methods of thermo gravimetric analysis, principles and application of TGA and DTA</p> <p>CO 3: Principles of Spectrophotometric analysis and properties of electromagnetic radiations Different Terms and Law involved, Instrumentation and working of single and double beam spectrophotometer, Applications, Numerical Problems</p> <p>CO 4: Voltammetry and polarography as an analytical tool, Determination of Zn and Cd from the mixture.</p> <p>CO 5: AAS and FES as an analytical tool, Interferences in AAS and FES, Applications and numerical problems.</p>
	CH-344	Course: Analytical Chemistry	<p>CO 1: Principles of solvent extraction, Various types of techniques of solvent extraction, Difference between batch and multiple extraction and solve the numerical problems.</p> <p>CO 2: Principle of chromatographic methods, . Technique and applications of- Column Chromatography, Technique and applications of- Thin layer, Ion exchange Chromatography and Paper Chromatography.</p> <p>CO 3: Principle of GSC and GLC analysis Separation mechanism involved in Gas chromatography and HPLC, Instrumentation- stationary phases, column types, detectors, Working of Gas chromatography and HPLC , Chromatogram and use in qualitative-quantitative analysis, Applications of gas chromatography and HPLC.</p> <p>CO 4: Nephelometry and Turbidimetry as an analytical tool, Measurement of turbidance, Application and numerical problems .</p>
	CH-335	Semester- III Course: Industrial Chemistry	<p>CO 1: Importance of chemical industry, Meaning of the terms involved, Comparison between batch and continuous process, Knowledge of various industrial aspects,</p> <p>CO 2: Various insecticides, Pesticides, Fungicides, Rodenticides & biopesticides used in agriculture field with their synthesis and applications.</p> <p>CO 3: Concept of basic chemicals, their uses and manufacturing process, physico-chemical principles involved in manufacturing process.</p> <p>CO 4: Introduction, occurrence, composition of petroleum, resources, processing of petroleum, other properties, Fuels and eco-friendly fuels, use of solar energy etc</p> <p>CO 5: Nutritive aspects of food constituents,</p>

			<p>Quality factors and their measurements, Food deterioration factors and their control; Food preservation and Food additives.</p> <p>CO 6: Manufacturing of industrial starch and its applications, Characteristics of some food starches, Non-starch polysaccharides-cellulose-occurrence</p> <p>CO 7: Manufacture of cement by modern methods, Definition of setting and hardening, Reinforced concrete</p> <p>CO 8: learn about making of glass by different methods, Various operations involved in the manufacture and compositions, Properties and uses of special glasses.</p>
	CH-345	Semester- IV Course: Industrial Chemistry	<p>CO 1: Basics of polymer, Nomenclature, Degree of polymerization, Classification of polymerization reactions, Commercial polymers and their importance, Biomedical polymers: implants, Contact lens and dental polymers.</p> <p>CO 2: Importance of sugar industry, Manufacture of direct, Consumption (plantation white) sugar with flow diagram. Cane juice extraction by various methods, Concentration of juice by using multiple effect evaporator system, Crystallization of sucrose by using vacuum pan.</p> <p>CO 3: Importance, Basic requirement of fermentation process, Manufacturing of ethyl alcohol by using molasses, Food grains, fruits & ethylene. Manufacturing of wine, beer, whisky, rum etc.</p> <p>CO 4: Different types of soap products, Chemistry of soap. Know about various cosmetics, Raw materials, properties and various types of cosmetics used. Meaning of the terms detergent, Surfactants, emulsion and emulsifying agents, Raw materials for detergents,</p> <p>CO 5: Dye intermediates, reparation of dye intermediates, Structural features of a dye, Classification of dyes, Structures and applications of various dye</p> <p>CO 6: Introduction of paints, Ingredients and classification, New technologies; Properties of coatings, Solvents, plasticizers, dyes and bioactive additives.</p> <p>CO 7: Know General aspects of drug action:, Introduction, classification, Nomenclature, Structure-activity relationship, Action, , Assay, factors affecting drug action, Metabolism of drugs, And Chemical structures of drugs, Synthesis and uses of few drug molecules.</p> <p>CO 8: The students are expected to learn all the problems of pollution and deposal of waste of various industries.</p>
	CH-336E	Semester-III Course:	CO 1: Know the role of agriculture chemistry and its potential.

		Agriculture Chemistry	<p>CO 2: Understand basic concept of soil, properties of soil & its classification on the basis of pH.</p> <p>CO 3: Know the different plant nutrients, Their functions and deficiency symptoms</p> <p>CO 4: Understand importance of manures as compared to chemical fertilizers.</p> <p>CO 5: Understand the importance of green manuring.</p> <p>CO 6: Have the knowledge of various pesticides, insecticides, fungicides and herbicides.</p> <p>CO 7: Have the knowledge of quality irrigation water, water quality standard and analysis of water.</p>
	CH-336E	Semester-IV Course: Dairy Chemistry	<p>CO 1: Knowing importance of the subject from the point of rural economy.</p> <p>CO 2: Knowing the composition of milk, its food & nutritive value.</p> <p>CO 3: Understanding the Microbiology of the milk.</p> <p>CO 4: Understanding various preservation and adulterants, various milk proteins and their role for the human body.</p> <p>CO 5: Knowing various milk products, their composition, manufacture and uses.</p>


HOD


IQAC Coordinator




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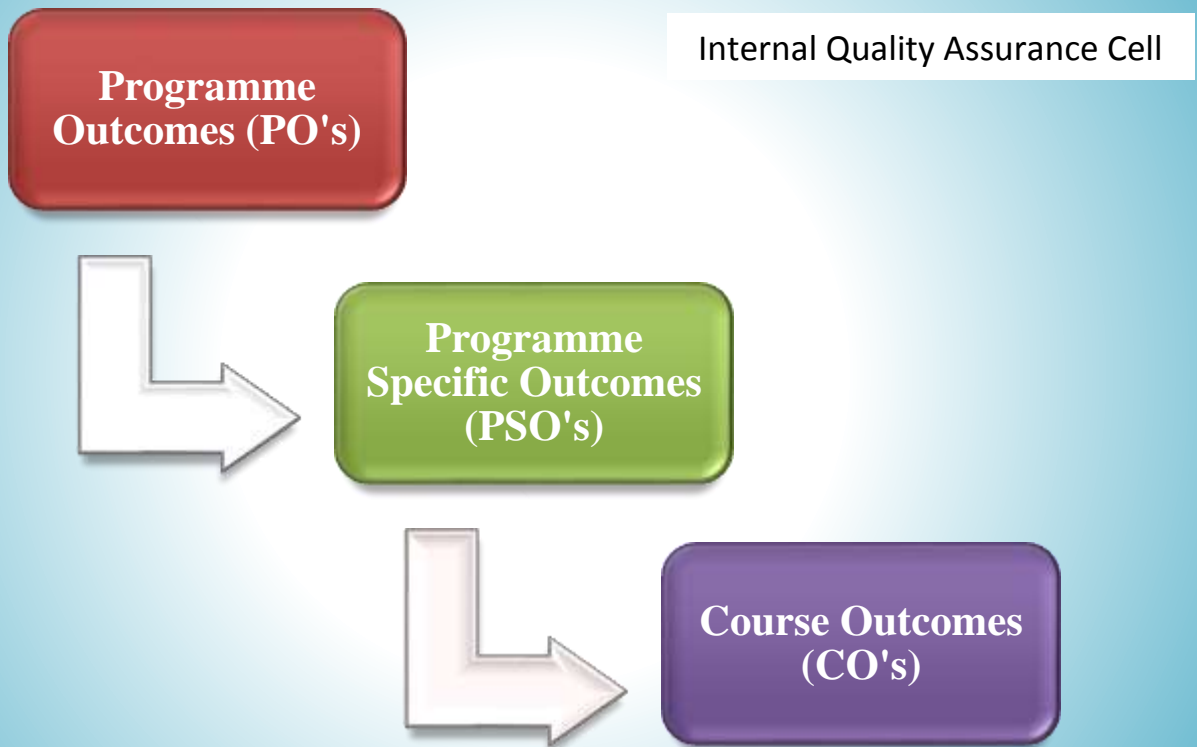
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Prof. (Dr) S. K. Kushare

M.Sc., Ph. D.

Programme Outcome (PO's), Programme Specific Outcome (PSO's), Course Outcome (CO's)

Department: Chemistry

Syllabus: 2019 Pattern

Sr. No.	Name of the Programme	Year of introduction of programme	Duration of introduction of Programme
1	B.Sc.Chemistry	1993	3 Years
2	M.Sc.Organic Chemistry	2008-2009	2 Years

Programme Specific Outcome (B.Sc Chemistry)

Programme Specific Outcome (B.Sc Chemistry)	
PSO 1	The chemistry graduates are able to apply knowledge of the fundamental concepts of chemistry and applied chemistry through theory and practical.
PSO 2	B.Sc. chemistry students are able to understand the scope, methodology and application of modern chemistry.
PSO 3	B.Sc. chemistry student able to Plan and conduct scientific experiments and record the results of such experiments.
PSO 4	B.Sc. chemistry student are acquaint with safety of chemicals, transfer, and measurement of chemicals, preparation of solutions, and using physical properties to identify compounds and chemical reactions
PSO 5	B.Sc. chemistry student are able to use modern chemical tools, models, charts and various useful equipments.
PSO 6	B.Sc. chemistry student able to explain the nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.
PSO 7	B.Sc. chemistry student describe how chemistry is useful to solve social, economic and environmental problem and issues facing our society in energy, medicine and health.

Programme Specific Outcomes (PSO): (B.Sc Chemistry)

Programme Specific Outcomes (PSO): (B.Sc Chemistry)	
PSO1	Apply the knowledge of Organic Chemistry in the domain of advanced research, education and perspective entrepreneurship.
PSO2	To analyze and interpret the UV-Vis, IR, NMR and HRMS spectral data of Organic compounds to understand the functional groups and their structural framework.
PSO3	Develops analytical skills and problem solving skills requiring application of chemical principles
PSO4	Develop an understanding of eco-friendly chemical processes and impact of chemistry on health and environment.
PSO5	M.Sc. chemistry student understands the background of organic reaction mechanisms, complex chemical structures, Instrumental method of chemical analysis, molecular rearrangements and separation techniques

CourseOutcome (B.Sc Chemistry)

F.Y.B.Sc Chemistry Course Outcomes

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
F.Y.B.Sc. Term-I	PAPER - I:	PHYSICAL & INORGANIC CHEMISTRY	CO 1: makes understanding of behavior of gases, ideal gas as a model system and its extension to real gases. The dependence of physical state on pressure, volume and temperature is being realized.
			CO 2: The existence of liquid state, comparison of its properties with other states to be perceived. Liquid crystal are essentials in all common and research devices and instruments hence they are introduced briefly
			CO 3: Student should be able to solve problems regarding van der Waal's and Critical constant and regarding P-V-T relations Understanding dynamic nature of surface and its applications in catalysis.
			CO 4: Students should know, Mole concept, GMV relationship, Student should be able to solve problems based on GMV relationship. Normality, Molarity, Normal solution, Molar solution, equivalent weight, ppm, % w/v, % v/v & related problems.
			CO 5: Standard solution, primary & secondary standard substances, standardization of solution & related problems.
			CO 6: Understand the concept of oxidation & reduction, oxidizing agent, reducing agent, redox reaction, oxidation number, Balance the equation by ion electron method & oxidation number method.
			CO 7: Calculation of Equivalent weight of oxidant & reductant
	PAPER - I		CO 1: Basic principle of overlapping of atomic orbital with specific shapes and sizes
			CO 2: Fundamental concepts of theories of overlapping of atomic orbitals
			CO 3: Concept of hybridization and differentiation with overlap
			CO 5: Concept of different types valence shell electron pairs and their contribution in bonding

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			CO 6: Application of non-bonded lone pairs in shape of molecule
			CO 7: Basic understanding of geometry and effect of lone pairs with examples.
	PAPER - II:	ORGANIC & INORGANIC CHEMISTRY	CO 1: Skeleton of long form of periodic table
			CO 2: Quantum numbers, Shells, sub-shells, types of orbital and their shapes, Aufbau, Paulin's exclusion principle and Hunds rule, Block, group, periodic law and periodicity
			CO 3: Name, symbol, electronic configuration, trends and properties
			CO 4: Crown ether and cryptans.
			CO 5: Separation of s-block elements with crown ethers, Compounds of s-block elements: oxides, hydroxides, peroxides and superoxides
F.Y.B.Sc. Term II			CO 1: Structure, nomenclature, preparation and reactions of organic compounds, The characteristic reactions of each functional group which can be used to identify and distinguish that compound from other compounds
			CO 2: Predict the conversion of one functional group into other functional group involving one or more number of steps.
			CO 3: Conversion of the given compound into other compound containing more or less number of carbon atoms.
			CO 4: Prediction of possible products when reactants are given. In case there are more than one possible products, identify the major and minor products.
			CO 5: Concept of isomerism, types of isomers and representation of organic molecules, Conformational isomerism in alkanes with energy profile diagram. Concept of geometrical isomerism with E/Z nomenclature. Understanding of optical activity, isomer number, tetrahedral carbon atom, concept of chirality, enantiomerism, R/S nomenclature for single chiral centre.
			CO 6: write electronic configuration of any element

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			CO 7: give reasons for anomalous behavior of first element of IIIA to VII A groups with other elements in the same group.
			CO 8: know the exact position p-block elements in the long form of the periodic table. Basic compounds of boron, aluminum, silicon
	Paper - III	Chemistry Practical Course	CO 1: Understand importance and scope of Analytical chemistry
			CO 2: Prepare lyophobic and lyophobic sols.
			CO 3: know the role of emulsifying agents in stabilizing the emulsion of different oils
			CO 4: determine the gas constant R in different units by eudiometer method.
			CO 5: determine relative viscosity of given organic liquids by viscometer.
			CO 6: determine DH and DS for the following chemical reactions
			CO 7: Determination of hardness of water , Carry out Inorganic qualitative analyses
			CO 8: determine amount of acetic acid in commercial vinegar
			CO 9: Analyse organic compound qualitatively.
S.Y.B.Sc.	CH-211	Physical and Analytical Chemistry	CO 1: Identify chiral center in the given organic compounds
			CO 2: Concept of distribution of solute amongst pair of immiscible solvents.
			CO 3: Distribution law and its thermodynamic proof
			CO 4: Distribution law and nature of solute in solution state.
			CO 5: Chemical analysis and its applications
			CO 6: Sampling, Common techniques, Instrumental methods and other techniques, Choice of method.
			CO 7: Meaning of error and terms related to expression & estimation of errors, Methods of expressing accuracy and precision, Classification of errors, Significant figures and computations
			CO 8: Basic principles in qualitative analysis, Meaning of common ion effect, Role of common ion effect and solubility p, Group reagent and precipitating agents

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			Interfering anions and its removal, Separation for basic radicals.
			CO 9: Classification of compounds with different functional groups, Characteristic tests for different functional groups, Quantitative analysis of C, H
	CH-212	Section – I Organic and Inorganic Chemistry	CO 1: Identify chiral center in the given organic compounds
			CO 2: Define Erythro, threo, meso, diastereoisomers with suitable examples
			CO 3: Explain the stability of cyclohexanes, Draw structure of conformations of mono- & disubstituted cyclohexanes
			CO 4: Define and classify heterocyclic compounds, Use Huckel rule to predict aromaticity, Write and complete various reactions of heterocyclic compounds
			CO 5: to differentiate between ore and minerals, differentiate between calcination and roasting and smelting
			CO 6: know the different methods for separation of gangue or matrix from metallic compounds, To know the terms smelting, flux.
			CO7: know physico-chemical principles involved in electrometallurgy. understand electrolysis of alumina and its refining, explain the uses of Aluminum and its alloys.
			CO 8: know different reactions in the blast furnace
			CO 9: explain the basic principles of different methods for preparation of steel.
			CO 10: Define ,Types, Mechanism, Factors affecting corrosion and Methods of prevention of metal from corrosion.
			CO 11: Meaning of passivity, Different theories of passivity, Galvanising, Tinning, Electroplating from corrosion.
	CH-221	Physical and Analytical Chemistry	CO 1: Free energy concepts, types and its variation, Free energy change for ideal gases
			CO 2: Gibb's Helmholtz equations and its properties & significance

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			CO 3: van't Hoff reaction isotherm and thermodynamic equilibrium constants
			CO 4: Ideal and non ideal solutions and laws governing these solutions.
			CO 5: Interpretation of vapor pressure–composition diagram.
			CO 6: Interpretation of temperature composition diagram.
			CO 7: Distillation from temperature – composition diagram, Azeotropes, Partially immiscible liquids.
			CO 8: Meaning of equivalent weight, molecular weight, normality, molality, primary and secondary standards. Preparation of standard solution, Calibrate various apparatus, Types instrumental and non instrumental analysis
			CO 9: Indicators, mixed and universal indicators, Know neutralization curves for various acid base titration
			CO 10: Know principle of complexometric precipitation and redox titrations, difference between iodometry and iodimetry, Determine the amount of halides separately and in presence of each other.
S.Y.B.Sc Sem II.	CH-222	Organic and Inorganic Chemistry	CO 1: Concept of different reagents used in the one type of conversion, Reagent based mechanisms, Suggest synthetic route for preparation of various heterocyclic compounds, Write and complete various reactions of heterocyclic compounds, different biomolecules.
			CO 2: role of biochemistry in the day to day life, Classify carbohydrates giving suitable examples.
			CO 3: Explain stereoisomerism in monosaccharide, Distinguish between diastereomers and epimers
			CO 4: Write cyclic structure of glucose, maltose, lactose, cellobiose and sucrose, maltose, lactose, cellobiose and sucrose
			CO 5: Classify the naturally occurring amino acids, Explains the amphoteric nature of amino acids, Classify proteins.
			CO 6: understand M-C bond and to define

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			<p>organometallic compounds, know position of d-block elements in periodic table.</p> <p>CO 7: know the general electronic configuration & electronic configuration of elements, know trends in periodic properties.</p> <p>CO 8: know methods of synthesis of binary metal carbonyls, understand the 18 electron rule, understand the catalytic properties of binary metal carbonyls</p> <p>CO 9: define acids and bases according to Arrhenius theory Lowery- Bronsted concept, Lewis concept, define the conjugate acid and base pairs, demonstrate the trends in the strength of hydracids, oxyacids, define hard and soft acids,</p> <p>CO 10: explain the properties of a solvent that determines their utility</p> <p>CO 11: know toxic chemical in the environment, know the impact of toxic chemicals on enzyme. explain biological methylation</p>
	CH – 223	Practical Course in Chemistry	<p>CO 1: Verify theoretical principles experimentally, Interpret the experimental data, Improve analytical skills, Correlate the theory and experiments and understand their importance</p> <p>CO 2: Acquire skill of crystallisation, record correct m. p. / b. p</p> <p>CO 3: Perform the complete chemical analysis of the given organic compound</p> <p>CO 4: Perform the given organic preparation according to the given procedure</p> <p>CO 5: Perform all the activities in the laboratory with neatness and cleanness</p> <p>CO 6: Interpret the experimental data.</p>
T.Y.B.Sc Sem I	CH-331	Semester-III Physical Chemistry	<p>CO 1: Expression for rate constant k for third order reaction, Examples of third order reaction</p> <p>CO 2: Experimental determination of order of reaction by Integrated rate equation method,</p>

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			CO 3: Explain the term energy of activation, Graphical evaluation of energy of activation
			CO 4: Ohm's law and electrical units such as coulomb, Ampere, Ohm and Volt, Meaning of specific resistance, specific conductance, cell constant and their units.
			CO 5: Cell constant, its theoretical and experimental determination, Experimental determination of conductance
			CO 6: Variation of specific and equivalent conductance of strong and weak electrolyte with dilution
			CO 7: Kohlrausch's law of independent migration of ions and its applications such equivalent conductance of weak electrolyte at zero conc., degree of dissociation,
			CO 8: Hittorf's rule and Experimental determination of transport number, Debye-Huckel-Onsager Interionic Attraction theory
			CO 9: Determine Activity and activity coefficient of strong electrolyte
			CO 10: Understand the term additive and constitutive properties
			CO 11: Understand the term specific volume, molar volume and molar refraction
			CO 12: Understand the meaning of electrical polarization of molecule, Dipole moment and its application
			CO 13: Know Rotational / Microwave spectroscopy, Vibrational Spectra, Raman Spectroscopy
			CO 14: Meaning and Types of equilibrium such as true or static, metastable and Unstable equilibrium
			CO 15: Derivation of phase rule, Explanation of water, sulphur and two component system.
	CH-341	Semester-IV Physical Chemistry	CO 1: What is mean by Electrochemical cell, Conventions used to represent electrochemical cell. . Construction, representation, working and limitation of Standard hydrogen Electrode, Calomel

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			and Silver –Silver Chloride electrode, Weston Standard Cell, Measurement of EMF of electrochemical cell
			CO 2: Nernst Equation for theoretical determination of EMF
			CO 3: Thermodynamics and EMF: Relation of EMF with ΔG , ΔG° , ΔH , ΔS and equilibrium constant K of the cell reaction
			CO 4: Classification of electrochemical cell, Electrode and electrolytic concentration cell,
			CO 5: Application of EMF measurement such as pH determination, Determination of solubility and solubility product.
			CO 6: Potentiometric titrations: Weak acid against strong base, Titration of polybasic acids, Precipitation and Redox titrations.
			CO 7: The atom its nucleus and outer sphere, Classification of nuclides with isotope, isobar, isotone and isomers
			CO 8: Explanation of stability of nucleus through neutron to proton ratio, odd and even nature of proton and neutron, Mean binding energy.
			CO 9: Explanation of binding energy curve, Measurement of radioactivity by G.M. and proportional counter,
			CO 10: Age determination- by Carbon-14 dating, Medical applications-Assess the volume of blood in patients body, Goitre.
			CO 11: Distinguish between crystalline and amorphous solids, anisotropic and isotropic solid
			CO 12: Explain the term crystallography and laws of crystallography, Weiss and Millers Indices, Crystal system and their characteristics, type of simple, body centred and face centred cubic crystals
			CO 13: Concept of quantization, Atomic spectra, Uncertainty principle and its physical significance, time independent Schrodinger wave equation., Wave function and its Interpretation, Particle in a box

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
	CH- 347	Physical chemistry Practicals	<p>CO 1: Verify theoretical principles experimentally, Interpret the experimental data, Improve analytical skills, Correlate the theory and experiments and understand their importance .</p> <p>CO 2: Acquire skill of handling, standardization, application of conductometer. Potentiometer,pH meter, Refractometer, colorimeter</p> <p>CO 3: Chemical Kinetics for determination First order, second order</p> <p>CO 4: study the effect of concentration of the reactants on the rate of hydrolysis of an ester</p> <p>CO 5: determine the energy of activation of the reaction between potassium iodide and potassium persulphate, determine the molecular weight of a high polymer, test the validity of Freundlich / Langmuir isotherm, determine the molecular refractivity</p> <p>CO 6: Colorimetry Determination of λ_{max} and concentration of unknown solution.To titrate Cu^{2+} ions with EDTA photometrically. To determine the indicator constant of methyl red indicator.</p>
	CH-332	Semester-III Inorganic Chemistry	<p>CO 1: Know the theories of covalent bond formation,Understand the need of concept of MOT, Understand and show the formation of bonding and antibonding MO's,Draw the MO energy level diagrams for homonuclear diatomic molecules,Draw the shapes of molecular orbitals, Understand the formation of molecule and construct MO energy level diagrams.</p> <p>CO 2: Know the meaning of various terms involved in coordination chemistry, Understand the chelating agents, chelate and stability of chelates and complexes,give the IUPAC name the co-ordination compound.Know the application of co- ordination compounds in biology and chemistry,define and explain isomerism in complexes</p>

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			CO 3: explain structure and magnetic behaviour of the complexes
			CO 4: Explain electroneutrality principle and different types of pi bonding
			CO 5: draw crystal field splitting diagrams of d orbital of metal ion in octahedral, tetrahedral, square planar or tetragonal ligand field
			CO 6: find high spin and low spin complexes, explain d-d transitions and colour of the complexes. Explain MOT of Octahedral complexes.
	CH-342	Semester-IV Course: Inorganic Chemistry	CO 1: The meaning of term f-block elements, Inner transition elements, lanthanides, actinides, Electronic configuration, Oxidation states, Separation and Use of lanthanide elements in different industries.
			CO 2 :The meaning of metal & semiconductor, The difference between metal, semiconductor and insulator.
			CO 3: Explain the electrical conductivity of metals with respect to valence electrons. n and p type of semiconductors, Meaning of superconductors and their structure.
			CO 4: Know the nature and crystal structures of solids. Know the effect of radius ratio in determining the crystal structure, Be able to solve simple problems based on Pauling's univalent radii and crystal radii, Be able to differentiate between the defects
			CO 5: Define the homogeneous catalysis, Give examples of homogeneous catalysts. Understand the essential properties of homogeneous catalysts-Give the catalytic reactions, Give the brief account of homogeneous catalysis.
			CO 6: Define the heterogeneous catalyst and heterogeneous catalysis, Understand the essential properties of heterogeneous catalysts. Give the catalytic reactions for oxidation, reduction and cyclization processes.
			CO 7: Identify the biological role of inorganic ions & compounds, Give the classification

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
	CH-348	Inorganic Chemistry Practicals	<p>of metals as enzymatic and non-enzymatic.</p> <p>CO 1: Verify theoretical principles experimentally, Correlate the theory and experiments and understand their importance.</p> <p>CO 2: Interpret the experimental data, Improve analytical skills.</p> <p>CO 3: Correlate the theory and experiments and understand their importance.</p> <p>CO 4: Different methods of estimation, preparation, and separation of analyte.</p>
T.Y.B.Sc Sem III and IV	CH-333	Semester III Course: Organic Chemistry	<p>CO 1: Definition and types of organic acid and base. The pka and pkb concepts, Effect of temperature on pka/pkb, Comparison between strengths of acids/bases, What is acid-base catalysis.</p> <p>CO 2: draw different types of disubstituted cyclohexane in Chair form, distinguish between geometrical and optical isomerism, Stability, energy calculations with potential energy diagram and optical activity of these conformers..</p> <p>CO 3: Definition and type of nucleophiles and leaving groups, Different types of nucleophilic substitution reactions, Definition of inversion and racemization, The kinetics, mechanism & stereochemistry of Sn1, SN2 and SNi reactions.</p> <p>CO 4: Different types of carbon-carbon unsaturated compounds, Orientation / rules in addition reactions, The structure of carbonyl group, Reactivity concept, Correct mechanism of addition reactions using different reagents.</p> <p>CO 5: Definition and types of elimination reactions, Different types of bases and leaving groups, The evidences, mechanism & stereochemical aspects of these reactions. E1, E2 or E1cB mechanism.</p>

			CO 6: Definition and types of aromatic substitution reactions, Classification of directing groups, The evidences, reactivity and mechanism of these reactions.
CH-343	Semester IV Course: Organic Chemistry		CO 1: Spectroscopy, Different regions of electromagnetic radiations, Various terms used in spectroscopy, Brief idea about the advantages of spectroscopic methods. CO 2: Meaning of terms Disconnection, Synthons, Synthetic equivalence, Functional Group Interconversion, Target Molecule and synthesis of some molecules by retrosynthesis approach. CO 3: rearrangement reaction, Different types of intermediate in rearrangement reactions, writes mechanism of some named rearrangement reactions. CO 4: What is UV, IR and NMR Spectroscopy , Different types of electronic excitations, vibrations, Applications of UV IR and NMR Spectroscopy. CO 5: terpenoids and alkaloids, methods of isolation/extraction and Synthesis of natural products. determine the structure compounds by chemical methods.
CH-349	Organic Chemistry Practical		CO 1: Type, Separation of mixture, Preliminary tests, Physical constants, Elements and Functional groups only. The purified samples of the separated components should be submitted. Separation and qualitative analysis of the binary Mixtures. CO 2: prepare compound, use of double burette method for titration. CO 3: Monitoring of the reaction and purification and able to record physical constant, uses TLC with proper selection of the solvent system.
CH-334	Semester-III Course: Analytical Chemistry		CO 1: Principles of common ion effect and solubility product, Factors affecting on solubility of precipitation, Phenomenon of super saturation and precipitation formation, Meaning of co-precipitation and post precipitation, Choice of liquid for washing the precipitate, Precautions during filtration, drying and ignition of

			precipitate, understanding of electrogravimetric principle and solve numerical problems.
			CO 2: Methods of thermo gravimetric analysis, principles and application of TGA and DTA
			CO 3: Principles of Spectrophotometric analysis and properties of electromagnetic radiations Different Terms and Law involved, Instrumentation and working of single and double beam spectrophotometer, Applications, Numerical Problems
			CO 4: Voltammetry and polarography as an analytical tool, Determination of Zn and Cd from the mixture.
			CO 5: AAS and FES as an analytical tool, Interferences in AAS and FES, Applications and numerical problems.
CH-344	Course: Analytical Chemistry		CO 1: Principles of solvent extraction, Various types of techniques of solvent extraction, Difference between batch and multiple extraction and solve the numerical problems.
			CO 2: Principle of chromatographic methods, . Technique and applications of- Column Chromatography, Technique and applications of- Thin layer, Ion exchange Chromatography and Paper Chromatography.
			CO 3: Principle of GSC and GLC analysis Separation mechanism involved in Gas chromatography and HPLC, Instrumentation- stationary phases, column types, detectors, Working of Gas chromatography and HPLC , Chromatogram and use in qualitative-quantitative analysis, Applications of gas chromatography and HPLC.
			CO 4: Nephelometry and Turbidimetry as an analytical tool, Measurement of turbidance, Application and numerical problems .
CH-335	Semester- III Course: Industrial		CO 1: Importance of chemical industry, Meaning of the terms involved, Comparison between batch and continuous process, Knowledge of various industrial aspects,
			CO 2: Various insecticides, Pesticides, Fungicides,

		Chemistry	<p>Rodenticides & biopesticides used in agriculture field with their synthesis and applications.</p> <p>CO 3: Concept of basic chemicals, their uses and manufacturing process, physic chemicals principals involved in manufacturing process.</p> <p>CO 4: Introduction, occurrence, composition of petroleum, resources, processing of petroleum, other properties, Fuels and eco-friendly fuels, use of solar energy etc</p> <p>CO 5: Nutritive aspects of food constituents, Quality factors and their measurements, Food deterioration factors and their control; Food preservation and Food additives.</p> <p>CO 6: Manufacturing of industrial starch and its applications, Characteristics of some food starches, Non-starch polysaccharides-cellulose-occurrence</p> <p>CO 7: Manufacture of cement by modern methods, Definition of setting and hardening, Reinforced concrete</p> <p>CO 8: learn about making of glass by different methods, Various operations involved in the manufacture and compositions, Properties and uses of special glasses.</p>
	CH-345	Semester- IV Course: Industrial Chemistry	<p>CO 1: Basics of polymer, Nomenclature, Degree of polymerization, Classification of polymerization reactions, Commercial polymers and their importance, Biomedical polymers: implants, Contact lens and dental polymers.</p> <p>CO 2: Importance of sugar industry, Manufacture of direct, Consumption (plantation white) sugar with flow diagram. Cane juice extraction by various methods, Concentration of juice by using multiple effect evaporator system, Crystallization of sucrose by using vacuum pan.</p> <p>CO 3: Importance, Basic requirement of fermentation process, Manufacturing of ethyl alcohol by using molasses, Food grains, fruits & ethylene. Manufacturing of wine, beer, whisky, rum etc.</p> <p>CO 4: Different types of soap products, Chemistry of soap. Know about various cosmetics, Raw materials, properties and various types of cosmetics used. Meaning of the</p>

			<p>terms detergent, Surfactants, emulsion and emulsifying agents, Raw materials for detergents,</p> <p>CO 5: Dye intermediates, reparation of dye intermediates, Structural features of a dye, Classification of dyes, Structures and applications of various dye</p> <p>CO 6: Introduction of paints, Ingredients and classification, New technologies; Properties of coatings, Solvents, plasticizers, dyes and bioactive additives.</p> <p>CO 7: Know General aspects of drug action:, Introduction, classification, Nomenclature, Structure-activity relationship, Action, , Assay, factors affecting drug action, Metabolism of drugs, And Chemical structures of drugs, Synthesis and uses of few drug molecules.</p> <p>CO 8: The students are expected to learn all the problems of pollution and deposal of waste of various industries.</p>
	CH-336E	Semester-III Course: Agriculture Chemistry	<p>CO 1: Know the role of agriculture chemistry and its potential.</p> <p>CO 2: Understand basic concept of soil, properties of soil & its classification on the basis of pH.</p> <p>CO 3: Know the different plant nutrients, Their functions and deficiency symptoms</p> <p>CO 4: Understand importance of manures as compared to chemical fertilizers.</p> <p>CO 5: Understand the importance of green manuring.</p> <p>CO 6: Have the knowledge of various pesticides, insecticides, fungicides and herbicides.</p> <p>CO 7: Have the knowledge of quality irrigation water, water quality standard and analysis of water.</p>
	CH-336E	Semester-IV Course: Dairy Chemistry	<p>CO 1: Knowing importance of the subject from the point of rural economy.</p> <p>CO 2: Knowing the composition of milk, its food & nutritive value.</p> <p>CO 3: Understanding the Microbiology of the milk.</p> <p>CO 4: Understanding various preservation and adulterants, various milk proteins and their role for the human body.</p>

			CO 5: Knowing various milk products, their composition, manufacture and uses.
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Class	Subject Code	Title	Cos: After successful completion of This course, student will be able to
M.Sc.-I Sem-I	CHP-110 Fundamentals of Physical Chemistry	Thermodynamics	CO 1: Understand basics of Chemical Thermodynamics: Calculation of ΔH , ΔS , ΔG and K
			CO 2: Gain the knowledge of Effect of temperature and pressure dependence for various chemical reaction partial molar quantities, concept of activity.
			CO 3: Learn Molecular Thermodynamics: Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics
			CO 4: Understand and Quantum Chemistry: Classical mechanics, black body radiation, photoelectric effect, orthonormal functions, hermitian operators, Schrodinger equation, particle in a box.
		Chemical kinetics and reaction dynamics	CO 1: To understand and learn zero, first, second, third, nth order rate equation,
			CO 2: To learn different kinetic reactions such as, Reversible reactions, parallel (side) reactions, consecutive (sequential) reactions, steady state approximation.
			CO 3: To understand different theories: Arrhenius theory, collision theory and transition state theory.
			CO 4: Gain the knowledge of Debye Huckel Limiting law, primary and secondary salt effects and understand Enzyme catalysis-Michaelis-Menten mechanism.
	CHI-130 Inorganic Chemistry	Molecular Symmetry and its Applications	CO 1: To develop a deep knowledge about Molecular Symmetry and Symmetry Groups.
			CO 2: To have a well defined idea on Representations of Groups: Matrix representation and matrix notation for geometric transformation
			CO 3: Understand Group theory and quantum mechanics:
			CO 4: To know and understand the Symmetry Adapted Linear Combinations, Molecular Orbital Theory and Application of Group

			theory to Infrared Spectroscopy
		Chemistry of Main group elements	CO 1: To familiarize about Hydrogen and its compounds, Alkali and alkaline earth metals, Organometallic Compounds of Li, Mg, Be, Ca, Na
			CO 2: To acquire knowledge about Boron Hydrides, preparation, structure and Bonding with reference to LUMO, HOM
			CO 3: To learn Allotropes of Carbon, C60 and compounds, Carbon nanotubes, synthesis, properties, structure-single walled, multi walled, applicati
			CO 4: To gain the knowledge of Oxidation states of nitrogen and their interconversion, PN and SN Compounds, Metal Selenides and Tellurides, oxyacids, and oxoanions of sulphur & nitrogen, Interhalogens, pseudohalagen.
	CHO-150 Basic organic chemistry	Structure reactivity and Stereochemistry	CO 1: To understand the Chemical bonding and basis of reactivity and MOT and VBT approach.
			CO 2: To familiarize about the bonding other than covalent bonding: Ionic, hydrogen bond, inclusion compounds, rotaxanes, catenanes, cyclodextrins, cryptands, fullerenes, crown ethers.
			CO 3: To learn about aromaticity: Benzenoid and non-benzenoid compounds, Huckels rule, antiaromaticity, Application to carbocyclic and heterocyclic systems,
			CO 4: Create knowledge on stereochemical principles, enantiomeric relationship, distereomeric relationship, R and S, E and Z nomenclature
		Organic reactions	CO 1: To recollect and familiarize the basic concepts of substitution reaction: SN1, SN2, SET and SNV mechanism
			CO 2: To develop a deep knowledge about the Aromatic Electrophilic substitution: like Friedel crafts alkylation and acylation, Nitration, halogenation, formylation, chloromethylation, sulponation.

			CO 3: To have a well defined idea on Aromatic nucleophilic substitution: S _N Ar, S _N 1, Benzyne and S _N R1 reactions
			CO 4: Understand and solve Addition reactions and Elimination reactions E1, E2, E1cb mechanisms
	CHP-107 Physical Chemistry Practical		CO 1: Students will be able to understand standardization of Conductometry, Potentiometry, pH metry, Polarography.
			CO 2: Uderstand kinetic decomposition of diacetone alcohol by dilatometry.
			CO 3: Analyse and apply the theoretical principles of chemical kinetics
			CO 4: Evaluation of unknown concentration of solutions using techniques like conductometry, potentiometry and viscosity measurements
	CHI-147 Inorganic Chemistry Practical		CO 1: To analyze alloys and ores
			CO 2: To acquire knowledge about synthesis and properties of nano particles
			CO 3: To familiarize the preparation of inorganic complexes.
			CO 4: To be aware of the characterization of inorganic complexes.
M.Sc.-I Sem-II	CHP-210 Fundamentals of Physical Chemistry II	Molecular Spectroscopy	CO 1: To understand the basic principles and theory of IR, Raman, and Electronic spectroscopy.
			CO 2: Apply the theory to simple problems
			CO 3: To learn Rotation spectra- based on moment of inertia, rigid rotor, most intense line, isotopic effect on the rotational spectra, non-rigid rotator, diatomic molecules, linear triatomic molecules, symmetric top molecules, stark effect
		CO 4: To understand vibrational rotational spectra, fine structure in diatomic molecules, Born-Oppenheimer approximation, effect due to nuclear spin, parallel and perpendicular vibrations.	
		Nuclear and radiation	CO 1: To learn about applications of radioactive isotopes in various fields

		Chemistry	CO 2: To develop a deep knowledge about valence bond theory, hybrid orbitals, geometry and hybridization, molecular orbital
			CO 3: To understand the basic principles of crystallography
			CO 4: To acquire knowledge about Unit Cell, types of crystals, Miller Indices, Bragg Equation, Crystal structure determination from X-ray data, Bravais Lattices.
	CHI-230 Inorganic Chemistry	Coordination Chemistry	CO 1: To acquire deep knowledge in coordination compounds
			CO 2: To understand the scope of ligand fields theory of coordination complexes
			CO 3: To learn and understand the Russell-Saunders terms, strong field effect, correlation diagrams, Tanabe-Sugano Diagrams, Spin-Pairing energies.
			CO 4: To know and understand the Magnetic Properties of Coordination Complexes
		Bioinorganic Chemistry	CO 1: To have a detailed idea on overviews of bioinorganic chemistry
			CO 2: Students will be able to know Principles of Coordination Chemistry related to Bioinorganic Research and Protein, Nucleic acids and other metal binding biomolecules.
			CO 3: Create knowledge on Iron: Ferritin, Transferrin, Fe-S clusters, Porphyrin based systems.
			CO 4: To acquire knowledge about Biochemistry of Na, K and Ca w.r.t. Na/K pumps, Calmodulin and blood coagulation.
	CHO-250 Synthetic organic chemistry and spectroscopy	Synthetic Organic Chemistry	CO 1: To Learn about the application of various oxidising and reducing agents used in organic synthesis
			CO 2: Knowledge of Beckmann, Hofmann,, Curtius, Smith, Wolff, Lossen, Bayer-villiger, Sommelet, Favorskii, Pinacol-pinacolone, Benzil-benzilic acid, Calsien, Cope, Fries
			CO 3: Gain knowledge about Ylides

			CO 4: To know and learn role of different reagents such as, Grignard, organo zinc, organo copper, organo lithium.
		Spectroscopy	CO 1: The learners should be able to apply the different spectroscopic methods to solve problems
			CO 2: Using spectral data for explaining important organic reactions and functional transformations.
			CO 3: To understand PMR: Fundamentals of NMR, CW and FT-NMR,
			CO 4: Know and understanding CMR and mass spectrometry
CHA-290 General Chemistry	Concept of Analytical Chemistry		CO 1: Understand Data Handling and Spreadsheets in Analytical Chemistry
			CO 2: To learn the Sampling, Calibration and Standardization
			CO 3: To gain the detail knowledge about the Separation by precipitation, separation by distillation, separation by extraction, separation by ion exchange chromatography.
			CO 4: Acquired the knowledge of Chemical aspects to Nanomaterials
	Organometallic and Inorganic Reaction Mechanism		CO 1: Learn and understand 18 electron rule, ligands in organometallic chemistry, Fullerene complexes, carbene and carbene complexes,
			CO 2: To acquire deep knowledge of reactions involving gain and loss of ligands, reactions involving modification of ligands, organometallic catalysis and heterogeneous catalysis
			CO 3: Detail idea about Substitution reactions: Inert and labile complexes, Kinetics Consequences of reaction pathway, Stereochemistry of reactions:
			CO 4: Understand the trans effect
CHO-247 Organic Chemistry Practical			CO 1: Use the computational tools to draw the reaction schemes and spectral data to various organic reactions.
			CO 2: Apply class room learning in separation and

			purification of organic compounds and binary mixtures
M.Sc.-II Sem-III	CHO-350	Organic Reaction Mechanism	CO 1: Gains complete knowledge about Carbanions-Formation, stability and related name reactions.
			CO 2: Be able to describe the Enamines – formation and applications and Reactions of carbenes and nitrenes.
			CO 3: Student should able to learn the Generation of radiaclds, Stable free radicals, Nucleophilic and electrophilic radicals.
			CO 4: To understand the characteristics reactions, -Free radical substitution.
	CHO-351	Spectroscopic Methods in Structure Determination	CO 1:The learners should be able to apply the different spectroscopic methods to solve problems
			CO 2: Students learn the basic principles and applications of ^1H NMR, ^{13}C NMR, 2D NMR and Mass Spectrometry
	CHO-352	Organic Stereochemistry	CO 1: students will able to explain Stereochemistry of six membered rings.
			CO 2: To learn and understand fused Bridged and caged rings
			CO 3: To understand geometrical Isomerism and Stereochemistry of olefins
			CO 4: Familiarize the Determination of stereochemistry of organic compounds using NMR.
	CHO-353	Photochemistry, Pericyclic Reactions and Heterocyclic Chemistry	CO 1: To understand the General basic principle of photochemistry and their application in synthesis
			CO 2: Student should able to learn different pericyclic reactions
CO 3: Able to gain and acquire the knowledge of heterocyclic chemistry			
M.Sc.-II Sem-IV	CHO-450	Chemistry of Natural Products	CO 1: To understand structure and stereochemistry of Hardwickiic acid, Camptothecin and podophyllotoxin
			CO 2: Able to know about Taxol, Estrone and Mifepristone synthesis
			CO 3: To learn the building blocks and construction mechanism of Terpenoids and

			Alkaloids
	CHO-451	Advanced Synthetic Organic Chemistry	<p>CO 1: To know and understand transition metal complexes in organic synthesis ; only Pd, Ni, Co, Fe</p> <p>CO 2: To learn C=C formation reactions: Wittig, Horner-Wordworth-Emmons, Shapiro, Bamford-Stevens, McMurry, Julia-Lythgoe and Peterson olefination reactions</p> <p>CO 3: Familiarize the Ring formation reactions: Pausan-Khand, Bergman and Nazarov cyclization</p> <p>CO 4: Understand Click chemistry: criterion for click reaction, Sharpless azides cycloadditions</p>
	CHO-452	Carbohydrate and Chiron approach, Chiral Drugs and Medicinal Chemistry	<p>CO 1: Able to know about carbohydrates: structures of triose, tetrose, pentose, hexose,</p> <p>CO 2: should be understand the concept of chiral templates and chirons wherein the carbon skeleton is the chiral precursor.</p> <p>CO 3: To learn utilisation of the basic concepts for retrosynthetic strategy and synthesis of (S) Propanediol, (R) and (S) – Epichlorohydrin, L (+)-Alanine, (-) Multistratin, (-) Pentenomycin, (-) Shikimic acid,</p> <p>CO 4: Able to gain the knowledge of Introduction of chiral drugs, Eutomer, Distomer and eudesmic ratio, Distomers</p>
	CHO-453	Designing Organic Synthesis and Asymmetric Synthesis	<p>CO 1: Gain knowledge about the designing of organic synthesis: Protection and de-protection of hydroxyl, amino, carboxyl, ketone and aldehyde</p> <p>CO 2: To know the Principles and applications of asymmetric synthesis:</p>
	CHO-347	Single stage preparations	<p>CO 1: To acquire knowledge on the various reagents employed for their synthesis</p> <p>CO 2: Students will be able to performed Fourteen single stage and three Isolation of Natural products on micro scale.</p>
	CHO-447	Two stage preparations	CO 1: know the methodology to handle chemicals, heating methods and error

			analysis
			CO 2: Students will be able to performed ten two stage preparations and
	CHO-448	Project/Industrial training/Green Chemistry and Chemical biology experiments	CO 1: Able to know about Literature survey, research methodologies,
			CO 2: To understand Data Analysis, Column and TLC chromatographic techniques, Characterization of the products by analytical and spectral methods
			CO 3: understand the procedure for handling chemicals and analysis
			CO 4: understand the principle of techniques used for the purification of compounds
			CO 5: know about importance of various titrimetric methods

Course Specific Outcome (M.Sc Chemistry)

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
M. Sc Sem-I	CHP-110 Physical Chemistry	Fundamentals of Physical Chemistry	CO 1: Understand State function, path function, exact differential and inexact differential, internal energy and enthalpy, entropy of irreversible changes, the Helmholtz and Gibbs function, Entropy and entropy change in an ideal gas with temperature and pressure
			CO 2: Understand Partial molar quantities, methods for determination of molar quantities, ideal solutions, Raoult's and Henry's law,
			CO 3: Understand applications of quantum chemistry, Learn Schrödinger wave equation, particle in one dimensional box, Normalization and orthogonality of wave function, particle in three dimensional box

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			CO 4: Learn valence bond theory, hybrid orbitals, geometry and hybridization, molecular orbital theory for di and tri atomic molecule, linear variation method, approximations underlying Huckel theory
		Chemical Kinetics and Reaction Dynamics	CO 1: Understand basic concept of the temperature dependent reaction rates, To learn consecutive reaction, parallel reactions, pre-equilibria, unimolecular reactions.
			CO 2: Acquire the knowledge of different reactions such as, Fast reactions: flash photolysis, flow technique, stopped flow technique, relaxation method. Learn the steady state approximation, chain reactions - free radical polymerization reaction
			CO 3: Gain and understand the knowledge of Collision theory of bimolecular gas phase reactions, diffusion controlled and activation controlled reaction in solution, activated complex theory of reaction rate and Learn Eyrings equation.
			CO 4: Understand and learn Michaelis mechanism, effect of pH and temperature on enzyme catalyzed reactions, limiting rate, Lineweaverburk and Eadie equation and plots, inhibition of enzyme action, competitive inhibition and non- competitive inhibition
			CO 5: Learn and understand Molecular energy levels, Boltzmann distribution law, partition functions and ensembles, Maxwell- Boltzmann and Fermi-Dirac
	CHI-130 Inorganic Chemist	Molecular Symmetry and its Applications	CO 1: Student should visualize/ imagine molecules in 3 dimensions. understand the concept of symmetry and able to pass various symmetry elements through the molecule
			CO 2: understand the concept and point group and apply it to molecules. understand product of

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
	ry		<p>symmetry operations</p> <p>CO 3: apply the concept of point group for determining optical activity and dipole moment. Student should understand the importance of Orthogonality Theorem,</p> <p>CO 4: They should able to learn the rules for constructing character table. Using reduction formulae should be able to find out the possible type of hybridization</p> <p>CO 5: Student should know the concept of SALC. Student able to find out character for reducible representation.</p> <p>CO 6: To know about projection operator. Apply projection operator to find out the normalized wave function for atomic orbital</p> <p>CO 7: Student should correlate the application of symmetry to spectroscopy. Students able to find out the possible modes of vibration. From the previous knowledge of symmetry student must able to find out which mode are IR active.</p>
		Chemistry of Main Group Elements	<p>CO 1: understand the detail chemistry of S and P block elements w.r.t. their compounds, their reactions and applications</p> <p>CO 2: learn the advance chemistry of boranes, fullerene, zeolites, polymers etc.</p> <p>CO 3: Acquire the knowledge of Organometallic chemistry of some important elements from the main groups and their applications.</p>
	CHO-150 Organic Chemistry	Basic Organic Chemistry	<p>CO 1: Understand the criteria for aromaticity in nonbenzenoid molecules and other advanced polycyclic aromatics</p> <p>CO 2: Understand the chemistry of monocyclic heterocycles, nomenclature and reactions</p> <p>CO 3: Learn the concept stereochemistry and its importance; their rules and the concept of chirality</p>

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			<p>CO 4: Understand the role of various reaction intermediates like carbocation, carbanion, carbenes, radicals, and nitrenes in organic reactions; concept of NGP</p> <p>CO 5: Able to describe mechanism of different rearrangement reactions. Appreciates the various steps involved in the molecular rearrangements.</p> <p>CO 6: Use synthetic reagent of oxidation and reduction for solving the problems</p>
		Basic Organic Chemistry	<p>CO 1: Understand some fundamental aspects of organic chemistry, to learn the concept aromaticity,</p> <p>CO 2: Learn heterocyclic compound containing one and two hetero atoms with their structure, synthesis and reactions.</p> <p>CO 3: know stereochemistry of organic compounds; able to do interconversion of Fischer to Newmann, Newmann to Sawhorse and vice versa, Able to assign R and S to given molecules; understand stereoselective and stereospecific reactions; acquire knowledge on topicity</p> <p>CO 4: Understand structure, formation, stability and related name reaction of intermediates like Carbocation, Carbanion, Free Radical, Carbenes and nitrenes</p> <p>CO 5: Learn rearrangement reaction with specific mechanism and migratory aptitude of different groups. study Ylides and their reaction</p> <p>CO 6: understands the basis of redox reaction; acquire knowledge about the reagents which causes selective oxidation / reduction in various compounds; learn the basic mechanism of oxidation / reduction in organic compounds.</p>
	CHG – 190 General	Introduction to Chemical	CO 1: Gain and acquire the knowledge of research in both chemistry and allied fields of science and technology.

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
	Chemistry	Biology-I	CO 2: Students will be able to function as a member of an interdisciplinary problem solving team.
			CO 3: To impart the students thorough idea in the chemistry of carbohydrates, amino acids, proteins and nucleic acids etc.
			CO 4: Be able to describe the chemical basis for replication, transcription, translation and how each of these central processes can be expanded to include new chemical matter.
			CO 5: Develop skills to critically read the literature and effectively communicate research in a peer setting.
	CHG-190 Inorganic Chemistry Practical	Inorganic Material Analysis, Synthesis and Applications	CO 1: Analysis of Silica and Manganese from pyrolusite ore and silica and iron from hematite ore.
			CO 2: Identification of tin and lead from solder alloy and iron and chromium from stainless steel alloy.
			CO 3: Synthesis of ZnO from zinc oxalate - precursor method and determine band gap by absorption spectroscopy
			CO 4: Synthesis of Colloidal silver nanoparticles and determine band gap by absorption spectroscopy
	CHP-107 Physical Chemistry Practical	Basic Practical Chemistry	CO 1: Calculation of mean and standard deviation for Given data and least square method for calibration curve method.
			CO 2: Chemical Kinetics: Understand the concept of rate of reaction and order of reaction, Determination of rate of reaction, overall order of reaction and half life period.
			CO 3: Determine the radius of Glycerol molecule from viscosity measurement.
			CO 4: Estimation of concentration of metal ions by spectrophotometri method
	CHP-107 Organic Chemistry	Basic Practical Chemistry	CO 1: Learn and understand laboratory safety, handling of glassware, handling flammable and toxic solvent.

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
	y Practical		CO 2: Purification of two organic solids by recrystallization method and liquids by distillation method CO 4: Understand the concept of green chemistry CO 5: Monitoring of reactions using TLC
M. Sc Sem II	CHP-210 Physical Chemistry	Molecular Spectroscopy	CO 1: Studied details of Microwave Spectroscopy CO2: Learn a Infra-red Spectroscopy CO 3: Acquire the knowledge of Raman Spectroscopy CO 4: Understand electronic spectra of diatomic molecules CO 4: Learn Mossbauer Spectroscopy and understand Principle, Instrumentation and Applications of Mossbauer Spectroscopy.
		Nuclear Chemistry	CO 1: Understand types of radioactive decay, general characteristics of radioactive decay, decay kinetics, general expression for the activity of a daughter nuclide, Geiger- Nuttalis law, α -decay CO2: Solved a problem in classical physics, Internal conversion and the Auger effect. Learn Interaction of radiation with matter, interaction of γ radiation with matter, units for measuring radiation absorption, Radiation dosimetry, Radiolysis of water, free radicals in water radiolysis, Radiolysis of some aqueous solutions. CO 3: Gain and acquire the knowledge nuclear fission, fission fragments and their mass distribution, charge distribution, Ionic charge of fission fragments, fission energy, fission cross-section and threshold, fission neutrons, theory of nuclear fission, Neutron evaporation and spallation. CO 4: Understand and learn typical reaction involved in the preparation of radioisotopes, The Szillard- Chalmers reaction, Radiochemical

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			principles in the use of tracers
	CHI-230 Inorganic Chemistry	Coordination Chemistry	CO 1: Student should be able to find out the no of microstates and meaningful term symbols, construction of microstate table for various configuration
			CO 2: Student able to find out splitting of the free ion terms in weak ligand field and strong ligand field
			CO 3: Student should know basic d-d transition, d-p mixing, charge transfer spectra.
			CO 4: Understand the concept of spectrochemical series and Nephelauxetic series.
			CO 5: Should be able to solve numerical based on crystal field parameters.
		Bioinorganic Chemistry	CO 1: Understand Importance of bioinorganic chemistry and Role of metals in Metalloprotein and metalloenzymes
			CO 2: Learn Importance and transport of metal ions and Passive transport metal ions by ionophores and gramicidin
			CO 3: Mechanism for active transport of Na ⁺ and K ⁺ and Nerve impulse generation in rod cell of retina.
			CO 4: Importance and function of Ca, Fe and Mg in metalloprotein
			CO 5: Learn Catalytic role of Mn in photosynthesis.
	CHO-250 Organic Chemistry	Photochemistry and Pericyclic reaction	CO 1: Learn Principles of Photochemistry, photochemistry of carbonyl compounds, alkenes, dienes, and aromatic compounds, photo rearrangements, Barton reaction
			CO 2: Students should be able to understand free radicals formation, stability and reactivity and should also be able to use the basic understanding in writing probable reaction mechanisms.
			CO 3: MOT and will be able to extend this in predicting reaction mechanism and stereochemistry of electrocyclic reactions.

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to	
		Organic spectroscopy	CO 1: Students should able to solve $^1\text{H-NMR}$ problems and interpret the structure using $^{13}\text{C-NMR}$ data	
			CO 2: Students should able to calculate wavenumber of organic compounds and able to correlate IR bands with functional groups using numerical data	
			CO 2: Students should know various key factors responsible for the spectroscopic data acquisition and should able to solve Problems based on UV, IR, MS, $^1\text{H-NMR}$, $^{13}\text{C-NMR}$.	
			CO 3: The concepts in free radical reactions, mechanism and the stereo chemical outcomes.	
			CO 4: The basic principle of spectroscopic methods and their applications in structure elucidation of organic compounds using given spectroscopic data or spectra.	
	CHG-290 General Chemistry	Introduction to Chemical Biology	CO 1: Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.	
				CO 2: Students will be able to function as a member of an interdisciplinary problem solving team.
				CO 3: To impart the students thorough idea in the chemistry of carbohydrates, amino acids, proteins and nucleic acids etc.
				CO 4: Develop skills to critically read the literature and effectively communicate research in a peer setting.
	CHG-290 General Chemistry Practical	Electroanalytical Techniques of Analysis	CO 1: Calibration of pH-meter and To determine dissociation constant,	
				CO 2: To standardized potentiometer and find out stability constant, solubility and ionic products.
				CO 3: Calibration of conductometer and analyze the data to determine λ_0 or λ_a and dissociation constant of acetic acid and ΔG , ΔH , and ΔS of silver benzoate

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
	CHP-227 Inorganic Chemistry Practical	Basic Practical Chemistry	CO 1: Synthesis of coordination complexes and determine their % purity
			CO 2: To verify the Debye Huckel theory of ionic conductance for strong electrolytes
			CO 3: Determine solubility product and Structural determination of metal complexes by conductometric measurement
			CO 4: To understand equilibrium constant of M – L systems by Job's continuous variation method
	CHP-227 Organic Chemistry Practical	Basic Practical Chemistry	CO 1: Students are trained to different purification techniques in organic chemistry like recrystallization, distillation, steam distillation and extraction.
			Students are made aware of safety techniques and handling of chemicals.
			CO 2: Students are made aware of carrying out different types of reactions and their workup methods.
			CO 3: This practical course is designed to make student aware of green chemistry and role of green chemistry in pollution reduction.
			CO 4: The course includes synthesis of some derivatives and organic compounds, which will help them while working in research laboratory in future.
Class	Subject code	Title	Cos: Aftersuccessfulcompletionof thiscourse, studentwillbeableto
MSc Sem-III	CHO-350	Organic Reaction Mechanism	CO 1: Understand the Methods for determining Reaction Mechanisms
			CO 2: Learn Free Radicals: Generation, stability, reactivity, Free radical substitution, addition to multiple bonds, radicals in synthesis, Inter- and intra-molecular bond formation.
			CO 3: Able to understand Linear Free Energy Relationships
			CO 4: Understand Hammett plots, Hammett equation, substituent constants, reaction constants, use of

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			Hammet plots.
			CO 5: To learn calculation of k and K, Deviations from straight line plots, Taft equation, solvent effects.
		Biogenesis: The Building Blocks and Construction Mechanism	CO 1: Understand Terpenoids: Mono-, Sesqui-, Di-, tri-terpenoids and cholesterol,
			CO 2: Learn Alkaloids: Derived from ornithine, lysine, nicotinic acid, tyrosine and tryptophan.
			CO 3: Gain the knowledge of Shikimate pathway: Cinnamic acids, lignans and lignin, coumarins, flavonoids and stilbens, isoflavanoids and terpenoid quinones.
			CO 4: To know a case study: Alkaloids isolated from the Roots of Piper nigrum
	CHO-351	Structure Determination of Organic Compounds by Spectroscopic Methods	CO 1: Learn NMR in Stereochemistry Determination
			CO 2: Acquire the knowledge of ¹³ C NMR spectroscopy - APT, DEPT and INEPT
			CO 3: Understand ¹⁵ N, ¹⁹ F and ³¹ P NMR spectroscopy
			CO 4: Learn 2D NMR spectroscopy in structure elucidation.
		Mass Spectrometry	CO 1: Understand Mass Spectrometry: Principle, ionization methods and FAB Fragmentation of typical organic compounds.
			CO 2: Learn applications of Mass Spectrometry: Determination of the elemental composition, Isotopic Abundance in structure establishment; Analysis of Biomolecules
	CO 3: Problems solving: Structure elucidation using UV, IR, 1D NMR and 2D NMR, APT, DEPT and MS data as well as spectra		
	CHO-352	Stereochemistry	CO 1: Learn Conformations of polysubstituted cyclohexane, six membered rings with SP ² carbon, heterocycles with N and O, anomeric effect,

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
			stereochemical concept of I- Strain
			CO 2: Understand Stereochemistry of fused and bridged ring system
			CO 3: Learn configuration, Cram's rule, Cram's cycle model, Cram's dipolar model, Felkin-Anh Model;
			CO 4: Understand Resolution and analysis of stereomers - formation of racemization and methods of resolution, Stereochemistry of a polymer chain – Types and examples of Tacticity
		Asymmetric Synthesis	CO 1: Understand Introduction of Asymmetric Synthesis, Chiral pool and Chiral auxiliaries.
			CO 2: Acquire the knowledge of Asymmetric Organocatalysis
			CO 3: Learn Asymmetric Aldol Reaction, Enantioselective, diastereoselective and double diastereoselective Aldol reactions.
			CO 4: Understand Transition Metal-Catalyzed Homogeneous Asymmetric Hydrogenation
			CO 5: Able to know Transition Metal-Catalyzed Homogeneous Asymmetric Hydroxylation and Epoxidation
	CHO-353-A	Protection - De-protection, Chiron approach and	CO 1: Learn Protection and de-protection of functional group in organic synthesis: Hydroxyl group- alkyl ether, benzyl ether, acyl, PMB, Tritel, TMS, TBDMS, THP, MOM, MEM, MIP ether, Diol, Amines, Carboxyl group, Ketone and aldehydes
			CO 2: Able to understand Chiron approach: a) Introduction, b) The concept of chiral templates and chirons, c) Utilization of the basic concepts in synthesis of (S) Propanediol, (R) and (S) – Epichlorohydrin, L (+)-Alanine, (-) Multistratin, (-) Pentenomycin and (-) Shikimic acid

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
		Carbohydrate Chemistry	CO 1: Understand the Basics of Carbohydrates:
			CO2: Learn glycosyl donor acceptor concept, general methods for glycosyl bond formation: Glycosyl halides, Trichloroacetimides, Glycals and Glycal derivatives, Thioglycosides, Phosphites, n-Pentyl glycosides, Sulfoxides, Diazirines, Alkylation of reducing sugars
			CO 3: Learn the synthesis of disachharides, trisachharides and polysachharides
	CHO-354 Practical	Solvent Free Organic Synthesis	CO 1: Students are made aware of carrying out different types of reactions such as, Pinacol coupling reaction, Reformatsky reaction, Knoevenagel condensation, Dieckmann condensation, Corrole Synthesis and their workup methods.
	CO 2: Able to learn different reactions such as, C–N, C–S, C–X bond formation reaction		
	CO 3: Students are made aware of safety techniques and handling of chemicals.		
	CO 4: Able to perform Other Solvent-Free Reactions and Solvent free supramolecular assembly formation		
MSc Sem-IV	CHO-450	Chemistry of Natural Products	CO 1: To understand total synthesis while maintaining the stereochemistry. Learn a case study: Longifolene – (All Nine syntheses from Advanced Organic Chemistry Carey, Sundberg; Part B).
			CO 2: Perform total Synthesis of i. Hirsutellone B, ii. Ribisins A and B, iii. Subincanadine E
			CO 3: Able to learn Vannusals
			CO 4: To understand Pinnaic acid
	CHO-451	Organometallic Reagents in Organic Synthesis	CO 3: Gain the knowledge of Transition metal complexes in organic synthesis.
		CO 4: Learn C=C formation reactions: Wittig, Horner-Wordworth-Emmons, Shapiro, BamfordStevens, McMurry, Julia-Lythgoe and Peterson olefination reactions.	

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to		
			CO 3: Understand Ring formation reactions: Pausan-Khand, Bergman and Nazarov cyclization		
			CO 4: Able to understand Click chemistry: criterion for click reaction, Sharpless azides cycloadditions. Click reactions in synthesis of bioconjugates.		
	CHO-452	Medicinal Chemistry	CO 1: To Learn Peptides and proteins and Problem solving.		
			CO 2: Able to Understand Peptides, sequencing and their applications in therapeutics, Solution phase and solid phase peptide synthesis and Modern techniques for biomolecules and disease diagnosis.		
			CO 3: Able to know Introduction to medicinal Chemistry.		
			CO 4: Know about Pharmacokinetics and Pharmacodynamics of drug.		
			CO 1: To understand structure and activity Relationship: QSAR, Applications of SAR and QSAR in drug design		
			CO 2: Know about Introduction, Developments, SAR, Mode of action, limitations and adverse effect of Anti-infective Agents, Beta lactam antibacterial agents		
			CHO-453 Practical	Ternary Mixture Separation	CO 1: Understand and employ concept of type determination and separation
					CO 2: Meticulously record physical constants
	CO 3: Perform micro scale chemical elemental analysis				
	CO 4: Perform qualitative estimation of functional groups				
	CO 5: Recrystallize /distill the separated compounds				
	CO 6: Extend these skills to organic synthesis				
		Carbohydrates Synthesis	CO 1: To understand the meaning of dry condition in reaction.		
			CO 2: Workup of reaction in minimum quantity of		

Class	Subject code	Title	Cos: After successful completion of This course, student will be able to
		and Isolation of Natural Products	<p>water.</p> <p>CO 3: To acquire skill in handling of carbohydrates reaction.</p> <p>CO 4: Students should be able to collect reasonable quantities of color pigments to do the characterization and encouraged to use these pigments for developing food grade natural colors from lesser known plant sources.</p> <p>CO 5: Students should be able to collect a reasonable quantities of essential oils to do the characterization and They are encouraged to use these essential oils for the development of the products like soap, perfumes etc.</p> <p>CO 6: Students should be able to collect a reasonable quantities natural products to do the characterization and encouraged to study novel medicinal plants from their local area.</p>
		Project / Industrial Training/ Internships / Summer Project	<p>CO 1: Able to know about Literature survey, research methodologies,</p> <p>CO 2: To understand Data Analysis, Column and TLC chromatographic techniques, Characterization of the products by analytical and spectral methods</p>
	CHO-454 Practical	Convergent and Divergent Organic Syntheses.	<p>CO 1: Students should acquire pre-experiment (Reading MSDS, purification of reactants and reagents, mechanism, stoichiometry etc)</p> <p>CO 2: Students should understand post-experiment skills (work-up, isolation and purification of products, physical constants characterization using any spectroscopic methods etc.)</p>


HOD


IQAC Coordinator




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