



**PANSKURA BANAMALI COLLEGE(AUTONOMOUS)
DEPT. OF CHEMISTRY**

Programme: *B.Sc. (Chemistry Hons.)*

PROGRAMME SPECIFIC OUTCOMES (PSO):

The students graduating with the Degree B.Sc (Honours) in Chemistry will be able to gain core competency by understanding the systematic and coherent fundamental concepts in Physical chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry, and allied subjects along with the related experimental techniques. The disciplinary knowledge and skill of the graduates make them confident enough to perform the projects and analysis of chemistry-related problems in society and industry. After the completion of the course, the communication skill of the students is largely expanded to depict the different aspects of chemistry on the national and international platforms. The components of the program curriculum are also included in such a way that can be helpful to developing critical thinking ability in solving the problems and inquisitive nature of the students through appropriate questions, planning, and reporting experimental investigation. The course curriculum has been designed in such a way that the learner will be able to handle the field-based project and research project individually as a project manager/investigator. The embodiment of the chemistry curriculum must make the student an ethically awesome civilian with enough enthusiasm to be a life-long advanced learner.



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DEPT. OF CHEMISTRY**

COURSE OUTCOMES (COS): B.Sc. (Chemistry Hons.)

SEMESTER – I

CEMHCC1: INORGANIC CHEMISTRY-1

Course Outcomes:

Theory

- ✚ Knowledge of the shape of orbital and term symbols, and fundamental atomic rules
- ✚ Methodical study of elements through the periodic table
- ✚ Knowledge of various acid-base theories and acid-base titration curves
- ✚ Concept of redox and formal potential, the feasibility of reactions
- ✚ The idea of solubility product and precipitation
- ✚ Concept of radioelements and their properties

Practical

- ✚ Practical knowledge of instrument calibration
- ✚ Practical on acidimetric and alkalimetric titration
- ✚ Practical knowledge on oxidation and reduction process

CEMHCC2 : PHYSICAL CHEMISTRY-I

Course Outcomes:

- ✚ Description of macroscopic gas behavior including the distribution of velocities
- ✚ Ideal gas model, real gas models – especially van der Waals' gas model
- ✚ Transport behavior of fluids (liquid and gas)
- ✚ Fundamentals of thermodynamics with different thermodynamic processes
- ✚ Estimation of standard reaction enthalpy by various means
- ✚ Concept of chirality and stereochemistry

**CEMEGE1: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY
& ALIPHATIC HYDROCARBONS**

Course outcome:

- ✚ Concept of Atomic model and chemical forces
- ✚ Ionization potential, electron affinity, and various scales of electro negativity
- ✚ Hybridization and shape of molecules/ions
- ✚ Molecular orbital and bonding
- ✚ Inorganic quantitative analysis
- ✚ Fundamental of organic chemistry (theoretical and practical aspect)
- ✚ Concept of stereochemistry
- ✚ Qualitative analysis of organic compounds



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SEMESTER – II

CEMHCC3 : ORGANIC CHEMISTRY-1

COURSE OUTCOMES:

- ✚ Knowledge of basic organic chemistry
- ✚ Learning of stereochemistry
- ✚ Knowledge of aliphatic and aromatic hydrocarbon
- ✚ Practical knowledge of instrument calibration
- ✚ Practical on acidimetric and alkalimetric titration
- ✚ Practical knowledge on oxidation and reduction process

CEMHCC4: PHYSICAL CHEMISTRY-II

Course outcome:

- ✚ The idea of Electrolytes and Solubility Product
- ✚ Concept of partial molar quantities, especially chemical potential and their role in understanding the thermodynamics of mixing
- ✚ Concept of activity in the ionic atmosphere and how ion-ion interactions are taken into account in electrolyte solutions
- ✚ Understanding of statistical and the use of the suitable coordinate system and other mathematical techniques to simplify the calculation Explaining the nature of migration of ions in electrolyte solutions in the presence of an electric field - its quantification and preliminary modelling

CEMEGE2: Section I: PHYSICAL CHEMISTRY-1

Course outcome:

- ✚ Concept of Energetics of Chemical Reactions
- ✚ The fundamental concept of Chemical Kinetics and Chemical Equilibrium
- ✚ Fundamental of organic compounds with different functional groups
- ✚ Gather practical experience in Thermochemistry, pH, and Buffer solution Hands-on training in purification and Identification of Organic compounds.



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SEMESTER – III

CEMHCC 5: INORGANIC CHEMISTRY-II

COURSE OUTCOMES:

- ✚ Concept of different chemical forces
- ✚ To know the chemistry of main group s and p block elements
- ✚ Methodical study of s and p block elements
- ✚ Iodometric titration and preparation of various inorganic salts

CEMHCC6: ORGANIC CHEMISTRY-II

COURSE OUTCOMES:

- ✚ Knowledge of halogenated organic compounds, ether, alcohol, carbonyl, carboxylic acid, and amines and esters
- ✚ Practical knowledge of halogenation, alkylation, benzylation etc to detect functional groups.
- ✚ Functional group tests for alcohols, phenols and carbonyls. Practical
- ✚ knowledge of kinetics, equilibrium, and the phase rule

CEMHCC 7: PHYSICAL CHEMISTRY-III

COURSE OUTCOMES:

- ✚ **Concept of colligative properties and phase equilibria. Methodical study of kinetics, catalysis and surface chemistry**
- ✚ **Practical knowledge of kinetics, equilibrium, and the phase rule**

CEMHSE 1: PHARMACEUTICAL CHEMISTRY

COURSE OUTCOMES:

- ✚ **To gain the basic concept of drugs and pharmaceuticals.**
- ✚ **To design the pharmacophore for drug preparation.**
- ✚ **Analysis of drugs and preparation and analysis of Aspirine.**



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**CEMEGE3: SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE,
ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-II**

COURSE OUTCOMES:

- ✚ Extensive knowledge gathers on the solution phase equilibrium and conductance
- ✚ Knowledge of derivatives of organic compounds e.g., carboxylic acid, amines, esters, etc and the chemistry of amino acids, peptides, proteins
- ✚ Practical knowledge of qualitative analysis of organic compounds
- ✚ To know the separation of amino acid by paper chromatography
- ✚ Differentiation techniques of reducing and non-reducing sugars.
- ✚ Practical knowledge of kinetics, equilibrium, and the phase rule

SEMESTER – IV

CEMHCC 8: INORGANIC CHEMISTRY-III

COURSE OUTCOMES:

- ✚ Knowledge of chemistry of transition metals and lanthanides and actinides
- ✚ Study the properties like magnetism and color Concept of Bioinorganic Chemistry
- ✚ Practical knowledge of gravimetric analysis
- ✚ Procedures of inorganic preparation and metal separation techniques by the chromatographic method.

CEMHCC9: ORGANIC CHEMISTRY-III (THEORY)

COURSE OUTCOMES:

- ✚ Chemistry of nitrogenated organic compounds and polynuclear hydrocarbons
- ✚ Knowledge of Heterocyclic Chemistry and Alkaloid and Terpenoids
- ✚ Procedures of inorganic preparation and metal separation techniques by the chromatographic method.
- ✚ Finding procedure of extra element functional group of organic compounds

CEMHCC10: PHYSICAL CHEMISTRY-IV

COURSE OUTCOMES:

- ✚ Gather the concepts of conductance and electrochemistry
- ✚ Electrical and magnetic properties of atoms and molecules
- ✚ Conductometric and potentiometric analysis procedure of compounds.



PANSKURA BANAMALI COLLEGE(AUTONOMOUS)
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CEMHSE2: PESTICIDE CHEMISTRY

COURSE OUTCOMES:

- ✚ To gather basic knowledge of pesticides and their restrictions in uses
- ✚ Analysis and preparation of Pesticides.

CEMEGE4: SECTION I: TRANSITION METAL & COORDINATION CHEMISTRY (THEORY)

COURSE OUTCOMES:

- ✚ Knowledge of chemistry of transition metals and coordination compounds
- ✚ Study the properties like magnetism and color
- ✚ Concept of Bioinorganic Chemistry
- ✚ Chemistry of nitrogenated organic compounds and polynuclear hydrocarbons
- ✚ Knowledge of solid, liquid and gases
- ✚ Concepts of chemical kinetics
- ✚ Procedures of inorganic qualitative analysis in a mixture
- ✚ Experiments on surface tension, viscosity and kinetics.

SEMESTER – V

CEMHCC11: ORGANIC CHEMISTRY-IV

Course Outcomes:

- ✚ Knowledge gathering about the nucleic acid, amino acids and peptide/protein, and enzymes and lipids
- ✚ Concept about the biosynthesis of important bio-important molecules.
- ✚ Estimation of proteins, enzymes and experiments on oil/fat.
- ✚ DNA isolation and characterization processes.

CEMHCC12: PHYSICAL CHEMISTRY V

COURSE OUTCOME

- ✚ Learning about quantum chemistry and molecular spectroscopy.
- ✚ To know the photochemical and photophysical processes.
- ✚ Factor dependent UV-Visible spectroscopy experiments
- ✚ Colorimetric experiments and Lambert-Beer's Law



PANSKURA BANAMALI COLLEGE(AUTONOMOUS)
DEPT. OF CHEMISTRY

CEMHDSE 1: ANALYTICAL METHODS IN CHEMISTRY

COURSE OUTCOME

- ✚ To gather the knowledge of analytical methods (optical, thermal, and electroanalytical)
- ✚ Knowledge of separation techniques
- ✚ Methods learning of water analyses
- ✚ UV-Vis spectroscopic methods (colorometric estimations)
- ✚ Knowledge of chromatographic separation, solvent extraction.
- ✚ Food/drink pH estimation
- ✚ Experiments of soil testing

CEMHDSE 2: GREEN CHEMISTRY

COURSE OUTCOME

- ✚ Knowledge gathering about the principles of green chemistry and waste management
- ✚ Use of safer starting materials for the green route, microwave-assisted synthesis etc.

SEMESTER – VI

PAPER CEMHCC13: INORGANIC CHEMISTRY-IV

COURSE OUTCOME

- ✚ Knowledge of theoretical aspects of inorganic chemical analysis
- ✚ Knowledge of organometallics and catalysis by organometallics
- ✚ Study of reaction and mechanism of inorganic chemistry

PAPER CEMHCC14: ORGANIC CHEMISTRY-V

- ✚ Knowledge of Organic spectroscopy
- ✚ To learn the occurrence and classification of carbohydrates
- ✚ Knowledge of Dyes and Pigments
- ✚ Extraction of caffeine
- ✚ Urea-formaldehyde resin
- ✚ Identification of organic molecules by IR and NMR.



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DEPT. OF CHEMISTRY

CEMHDS3: INDUSTRIAL CHEMICALS AND ENVIRONMENT

COURSE OUTCOME

- ✚ Industrial gases and chemicals, and Environmental impact
- ✚ Concept of non-conventional energy sources
- ✚ Preparation and uses of Biocatalyst
- ✚ Analysis of BOD/OD/COD
- ✚ Estimation of SPM in air

PAPER CEMHDS4: INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

COURSE OUTCOME

- ✚ Theoretical aspects of spectral methods of analysis
- ✚ Atomic absorption and flame photometry: Theories and Practices.
- ✚ Chromatographic separation techniques: Theories and Practicals
- ✚ Immunoassay of proteins and other biomolecules
- ✚ Electroanalytical, Radiochemical and X-ray methods for chemical analysis.



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PROGRAMME: *B.Sc. (Chemistry GEN.)*

PROGRAMME SPECIFIC OUTCOMES (PSO):

The students graduating with the Degree B.Sc in Chemistry will be able to gain core competency by understanding the systematic and coherent fundamental concepts in Physical chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry, and allied subjects along with the related experimental techniques. The disciplinary knowledge and skill of the graduates make them confident enough to perform the projects and analysis of chemistry-related problems in society and industry. After the completion of the course, the communication skill of the students is largely expanded to depict the different aspects of chemistry on the national and international platforms. The components of the program curriculum are also included in such a way that can be helpful to developing critical thinking ability in solving the problems and inquisitive nature of the students through appropriate questions, planning, and reporting experimental investigation. The course curriculum has been designed in such a way that the learner will be able to handle the field-based project and research project individually as a project manager/investigator. The embodiment of the chemistry curriculum must make the student an ethically awesome civilian with enough enthusiasm to be a life-long advanced learner.



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COURSE OUTCOMES (COS): B.Sc. (Chemistry GEN.)

SEMESTER - I

PAPER DSC-I CHEMISTRY: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

Course outcome:

- ✚ Concept of Atomic model and chemical forces
- ✚ Ionization potential, electron affinity, and various scales of electro negativity
- ✚ Hybridization and shape of molecules/ions
- ✚ Molecular orbital and bonding
- ✚ Inorganic quantitative analysis
- ✚ Fundamental of organic chemistry (theoretical and practical aspect)
- ✚ Concept of stereochemistry
- ✚ Qualitative analysis of organic compounds

SEMESTER - II

CHEMISTRY-DSC II: CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC CHEMISTRY

Course outcome:

- ✚ Concept of Energetics of Chemical Reactions
- ✚ The fundamental concept of Chemical Kinetics and Chemical Equilibrium
- ✚ Fundamental of organic compounds with different functional groups Gather practical experience in Thermochemistry, pH, and Buffer solution Hands-on training in purification and Identification of Organic compounds.

SEMESTER - III

DSC-III CHEMISTRY: SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-II

COURSE OUTCOME

- ✚ Knowledge of solution chemistry, phase equilibrium, conductance, and electrochemistry
- ✚ Preparations and reactions of carboxylic acid & anhydride, esters, and amines.
- ✚ Gain the practical knowledge of partition coefficient, potentiometry, and equilibrium constant
- ✚ Hands-on training chromatography separation of amino acids
- ✚ Determination of protein concentration
- ✚ Differentiation of reducing and nonreducing sugar



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- ✚ Qualitative organic analysis of organic functional groups

SEC 1: PHARMACEUTICAL CHEMISTRY

COURSE OUTCOMES:

- ✚ To gain the basic concept of drugs and pharmaceuticals.
- ✚ To design the pharmacophore for drug preparation.
- ✚ Analysis of drugs and preparation and analysis of Aspirine.

SEMESTER - IV

DSC-IV CHEMISTRY: TRANSITION METAL & COORDINATION CHEMISTRY, STATES OF MATTER & CHEMICAL KIN

Course Outcomes:

- ✚ Primary Concept of Transition elements, Lanthanides, and actinides
- ✚ The persuasion of the structures and bonding of the coordination compounds
- ✚ Fundamentals of theories of gas, liquid, and solid.
- ✚ Experience in practicals on semi-micro qualitative analysis of inorganic radicals.
- ✚ Gain practical knowledge of gravimetric analysis. Hands-on practices of viscosity, surface tension, and kinetics of reactions

SEC2: PESTICIDE CHEMISTRY

COURSE OUTCOMES:

- ✚ To gather basic knowledge of pesticides and their restrictions in uses
- ✚ Analysis and preparation of Pesticides.

SEMESTER - V

DSE 1: ANALYTICAL METHODS IN CHEMISTRY

COURSE OUTCOME

- ✚ To gather the knowledge of analytical methods (optical, thermal, and electroanalytical)
- ✚ Knowledge of separation techniques
- ✚ Methods learning of water analyses



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- ✚ UV-Vis spectroscopic methods (colorimetric estimations)
- ✚ Knowledge of chromatographic separation, solvent extraction.
- ✚ Food/drink pH estimation
- Experiments of soil testing

SEC-III : CHEMISTRY OF COSMETICS & PERFUME

COURSE OUTCOME:

- ✚ Skill enhancement course increases the professional skill and techniques for handling the intimate chemicals like cosmetics, talc and perfumes that are used in everyday life.
- ✚ Discipline-specific course outcomes strengthen the learning and operating skills of various instruments and methodology in the field of interdisciplinary subjects.

SEMESTER - VI

DSE 2: GREEN CHEMISTRY

COURSE OUTCOME

- ✚ Knowledge gathering about the principles of green chemistry and waste management
- ✚ Use of safer starting materials for the green route, microwave-assisted synthesis etc.

SEC-IV FUEL CHEMISTRY

COURSE OUTCOME

- ✚ Skill enhancement course increases the professional skill and techniques in renewable energy and energy harvesting technology for the learners.
- ✚ Discipline-specific course outcome relies on the practices of environmentally and eco-friendly processes for the sustainable development of the world avoiding the long practices of hazardous methods in chemistry.
- ✚ Knowledge of green chemistry and adoption of green technology in Chemistry



PANSKURA BANAMALI COLLEGE(AUTONOMOUS)
DEPT. OF CHEMISTRY

PROGRAMME: M.Sc. (*Chemistry*)

PROGRAMME SPECIFIC OUTCOMES (PSO):

Education in India is mostly based on the foundation for understanding and realization of the specific subject. A society can achieve a pioneering model of education in the universe through a blending of theory and practical knowledge. Rationalization and interpretation of the natural phenomena through the model subject are accounted for by chemical science. The theories have contributed most to the understanding of the subject chemistry and qualitative models of bonding and reactivity clarify and systematize the subject. The ultimate authority consists of observations and measurements, such as identities of the product(s) of a reaction, structure, thermodynamic properties, spectroscopic signature, and measurement of reaction rates. The program outcome of the Master's in chemistry help the student to be a global researcher with a huge outlook on building a career in chemistry.

The program specific outcomes mainly concentrated on the following areas:

- PO1 :** Vertical progression in the specialized interdisciplinary subjects in the academic career like Post M. Sc and Ph. D in overseas and in India.
- PO2 :** Eligible professions in Teaching, Industries like Chemistry, Medicine, Pharmaceutical, Agricultural Chemistry, Oil industries, Biochemical, Mineral, Hydroelectric, Paint and Dyes industries, etc.
- PO3 :** Global leaders with profound outlook and trustworthiness convert the top achievers like scientists, industrialists, and international scholars.



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DEPT. OF CHEMISTRY

Programme: M.Sc. (Chemistry)

COURSE OUTCOMES (COS):

Semester- I		
Course	Course Title	Course Outcomes (COS)
CEM 101	PHYSICAL CHEMISTRY I	The students will learn the basics of Quantum Mechanics, Statistical Thermodynamics, Fundamentals of Electrochemistry and Molecular Spectroscopy.
CEM 102	ORGANIC CHEMISTRY	Knowledge gathering and learning of Organic Chemistry topics like pericyclic reaction, various organic transformations, terpenoids, and Actinoids.
CEM 103	INORGANIC CHEMISTRY	Students will understand the topic of Symmetry and Group Theory 1, Crystallography, Bioinorganic Chemistry, and Chemical Toxicology
CEM 104	FOOD PROCESSING AND PRESERVATION AND PHARMACEUTICAL CHEMISTRY	The students will gain an understanding of the topics of food processing and preservation, Food microbiology, and food preservation. The fundamentals of pharmaceutical chemistry and the various drugs and their constituents are also the outcomes of the course.
CEM 105	INORGANIC PRACTICAL	
CEM 106	FOOD PHARMACEUTICAL LAB	The students will be able to do the 1. Preparation of jams, jellies, syrups, squashes, 2. Preparation of mixed fruit juices: Aloe vera mixed with lichi, mango, pineapple, watermelon, etc. 3. Estimation of Food Values (carbohydrate, fat, protein, vitamins) and Food Safety Test. IV: Preservation of processed food V: Packaging of processed and preserved food 4. Synthesis and analysis of drugs- a) Ibuprofen, b) Paracetamol and c) Chloramphenicol



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Semester- II		
Course	Course Title	Course Outcomes (COS)
CEM 201	PHYSICAL CHEMISTRY II	The students will learn the advanced course in Quantum Mechanics, Statistical Thermodynamics, Fundamentals of Electrochemistry and Molecular Spectroscopy.
CEM 202	ORGANIC CHEMISTRY	Advanced knowledge gathering and learning of Organic Chemistry topics like pericyclic reaction, various organic transformations, Retrosynthesis, and basics of stereochemistry.
CEM 203	INORGANIC CHEMISTRY	Students can learn about organometallic chemistry, allotropes of carbon/boron, d-block elements, and advanced course in group theory
CEM 204	NANOTECHNOLOGY: PRINCIPLES AND PRACTICES	Students of other disciplines opt for the paper to gain knowledge on the smart material in the nano dimension range.
CEM 205	PHYSICAL PRACTICAL	
CEM 206	ORGANIC CHEMISTRY PRACTICAL	Hands-on training on the topic thin layer chromatography (TLC), extraction of important biomolecules, one-step or two steps processes of organic syntheses

Semester- III		
Course	Course Title	Course Outcomes (COS)
CEM 301	PHYSICAL SPECIAL I	Students can gather knowledge on quantum mechanics, and group theory
	ORGANIC SPECIAL I	The student will learn the energetics of organics reactions, pericyclic reactions and organometallic chemistry
	INORGANIC SPECIAL I	The outcome concentrates on the advanced topics like organometallics, application of group theory and chemistry
CEM 302	PHYSICAL SPECIAL II	Topics like statistical mechanics, chemical kinetics, and Advance electrochemistry have been persuaded by the learners.
	ORGANIC SPECIAL II	The students gain an advanced understanding of bioorganic and supramolecular chemistry.
	INORGANIC SPECIAL II	
CEM 303	SPECTROSCOPY FUNDAMENTALS	Common higher topics in Chemistry like Photophysical, LASER, EPR, PES and NQR are being learned by the students



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CEM 304	PHARMACEUTICAL CHEMISTRY	Students will gain an understanding of pharmaceutical chemistry, structure-activity, and the evaluation of drugs.
CEM 305	PROJECT IN PHYSICAL CHEMISTRY / ORGANIC CHEMISTRY/ INORGANIC CHEMISTRY	The pre-final project work will help the student to choose the novel problem in the subject of chemistry and allied fields emphasizing the review work and a concept (project) is find out to work further towards the partial fulfillment of the degree in Master in Chemistry

Semester- IV		
Course	Course Title	Course Outcomes (COS)
CEM 401	PHYSICAL SPECIAL III	The students learn the topic of quantum mechanics for many-electron systems (diatomic and polyatomic), and atomic spectra
	ORGANIC SPECIAL III	The students gain an understanding of the topics of organic photochemistry, and bio-relevant organic compounds
	INORGANIC SPECIAL III	The students will gain an understanding of the topic of magnetochemistry, clusters, and supramolecular chemistry of f-block elements
CEM 402	PHYSICAL SPECIAL IV	The topics like macromolecules, non-equilibrium thermodynamics, and solid-state chemistry have been demonstrated.
	ORGANIC SPECIAL IV	The students gain an understanding of the topics of advanced stereochemistry of organic molecules.
	INORGANIC SPECIAL IV	The students can learn the topics on reaction mechanisms in inorganic chemistry, and also gain ideas about analytical chemistry
CEM 403	SPECTROSCOPY FOR STRUCTURE ELUCIDATION	Analytical concepts to elucidate the structure of unknown compounds are being taught towards a meaningful understanding of the analyses.
CEM 404	FOOD PROCESSING AND PRESERVATION	The students will gain an understanding of food, beverages, milk, fruits & vegetables, fat & oil in light of chemistry
CEM 405	PROJECT IN PHYSICAL CHEMISTRY / ORGANIC CHEMISTRY/ INORGANIC CHEMISTRY	The final year project work will help the student to achieve the course-work of higher Degree Ph. D and the dissertation were completed which reflects the ability to adopt new projects in the future