Parvatibai Chowgule College of Arts and Science
Autonomous
Accredited by NAAC with Grade 'A' (CGPA Score 3.41 on a 4 Point Scale)
Best affiliated College-Goa University Silver Jubilee Year Award

LEARNING OUTCOME-BASED EDUCATION (LOBE)

for

Undergraduate Programme

BSc in Chemistry

(LOCF)

1. Introduction

B.Sc. Chemistry is an unique course designed to encourage aspiring students to pursue an undergraduate program that strengthen their basics , develop advanced knowledge in chemistry, give practical exposure and prepare them for gratifying professional careers and help them chase further studies.

2. Objective/Aim of BSc Programme

The Department of Chemistry at ParvatibaiChowgule College, Autonomous offers undergraduate three years B. Sc. degree in Chemistry. The department offers a variety of courses in basic as well as advanced areas of Physical, Organic, Inorganic and Analytical Chemistry. Our specialized elective courses include Pharmaceutical Chemistry, Environmental Chemistry, Nano-technology, Spectroscopy, etc.

We offer 24 courses, internships and research level 4 credit project to develop skills and achieve an in-depth knowledge in Chemistry. Laboratory experiments are based on syllabi. We organize seminars, Guest lectures, workshops and annual intercollegiate events to boost confidence in students to work in teams or in association with teachers. The department aims to provide quality education through use of Innovative Classroom teaching (ICT). For hands on training to students, we provide internship at various industries which helps to develop their skills and initiate them to a work environment.

With above 86% of faculties with PhD degrees, they are available to provide specialized (Research) knowledge in their respective fields of Chemistry. We also have instruments like UV-spectrometer, polarimeter, potentiometers and pH meters which enables to have hands on experience. We train our students to handle instruments and undertake projects in their area of interest.

Students will be empowered with basic to advance knowledge of Chemistry. They will develop skills of handling instruments which is required to work in industries and various other organizations like pollution control board, forensic departments, agriculture, petroleum industries, etc. They will be trained to resolve research problems through theory and laboratory courses.

3. Overview of Department

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specialized elective courses include Pharmaceutical Chemistry, Environmental Chemistry, Nano-technology, Spectroscopy, etc.We have three Classrooms and four Laboratories

We offer 24 courses, internships and research level 4 credit project to develop skills and achieve an in-depth knowledge in Chemistry. Laboratory experiments are based on syllabi. We organize seminars, Guest lectures, workshops and annual intercollegiate events to boost confidence in students to work in teams or in association with teachers. The department aims to provide quality education through use of Innovative Classroom teaching (ICT). For hands on training to students, we provide internship at various industries which helps to develop their skills and initiate them to a work environment.

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4. Graduate Attributes

Short Title of the Graduate Attributes	Description of the Graduate Attributes
Problem Analysis and Solutions	Think critically, identify, analyze problems/ situations and further attempt to design/ develop solutions that meet the specified goals.
Use of Technology	Apply appropriate IT tools efficiently in their daily activities of communication and academics.
Environment and Sustainability	Sensitize students to environmental issues and commit them to sustainable development in the local/ national and global context.
Ethics	Recognize and understand professional ethics /human values and be responsible for the same.
Individual and Team work	Function professionally in individual and team capacity to achieve desired performance.
Communication	Communicate proficiently (oral and written) as a responsible member of society.
Research Aptitude	Understand general research methods and be able to analyse, interpret and derive rational conclusions.

Life Skills	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of domain specific change.

5. Qualification of descriptors

The qualification descriptors for a Bachelor‟s Degree programme in Chemistry may include the following:

- Demonstrate (i) a fundamental/systematic or coherent understanding of the academic field of chemistry, its different learning areas and applications, and its linkages with related disciplinary areas/subjects; (ii) procedural knowledge that creates different types of professionals related to chemistry area of study, including research and development, teaching and government and public service; (iii) skills in areas related to specialization area relating the subfields and current developments in the academic field of chemistry.
- Use knowledge, understanding and skills required for identifying problems and issues relating to chemistry, collection of relevant quantitative and/or qualitative data drawing on a wide range of sources, and their application, analysis and evaluation using methodologies as appropriate to the subject(s) for formulating evidence-based solutions and arguments;
- Communicate the results of studies undertaken accurately in a range of different contexts using the main concepts, constructs and techniques of the subject(s);
- Meet one's own learning needs, drawing on a range of current research and development work and professional materials;
- Apply one's subject knowledge and transferable skills to new/unfamiliar contexts to identify and analyse problems and issues and solve complex problems with well-defined solutions.
- Demonstrate subject-related and transferable skills that are relevant to chemistry related job trades and employment opportunities

6. Programme Learning Outcomes (PLOs):

- Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.
- Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.

- Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research

- Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting

- Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.

- Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.

7. Course Structure:

SEMESTER	CORE COURSES		ELECTIVE COURSES				SKILL ENHANCEMENT COURSE
I	CHE-I. C-1 General Physical and Inorganic Chemistry	CHE-I. C-2 General Organic and Inorganic Chemistry	---	---	---	---	---
II	CHE-II. C-3 Concepts in Physical and Analytical Chemistry	CHE-II. C-4 Concepts in Organic and Inorganic Chemistry	---	---	---	---	---
III	CHE-III. C-5 Comprehensive Chemistry –I (Physical & Inorganic Chemistry)	---	CHE-III. E-1 Name Reactions and Synthetic Methodologies	CHE-III. E-2 Industrial Chemistry	CHE-III. E-3 Surface Chemistry and Catalysis	CHE-III. E-4 Bioinorganic Chemistry	CHE.SEC-1 Skill Development in Chemistry
IV	CHE-IV. C-6 Comprehensive Chemistry –II (Organic and Analytical chemistry)	---	CHE-IV. E-5 Pharmaceutical Chemistry	CHE-IV. E-6 Polymer and Colloid Science	CHE-IV. E-7 Spectroscopic Techniques	CHE-IV. E-8 Chemistry of Natural Products	CHE. SEC-2 Plating and corrosion CHE. SEC-3 Laboratory Techniques in Organic Chemistry

V	CHE-V. C-7 Advanced Chemistry – I (Physical & Inorganic Chemistry)	---	CHE-V. E-9 Heterocyclic Chemistry	CHE-V. E-10 Nanomaterials and Solid State Chemistry	CHE-V. E-11 Organometallic Chemistry	---	---
VI	CHE-VI. C-8 Advanced Chemistry – II (Organic and Analytical chemistry)	---	CHE-VI. E-13 Spectroscopic Methods in Organic Chemistry	CHE-VI. E-14 Environmental Chemistry	CHE-VI. E-15 Selected Topics in Inorganic Chemistry	---	---

8. **Course Description**

Course Title: General Physical and Inorganic Chemistry
Course Code: CHE- I. C-1
Course Objectives:

1. Will have a working knowledge of the main areas of Physical Chemistry, will develop critical thinking abilities and be able to work in chemical or related fields.
2. Will help to get better understanding about the basics of Physical and Inorganic Chemistry.
3. Will be able to carry out experiments with required skills.

Course Title: General Organic and Inorganic Chemistry
Course Code: CHE-I. C-2
Course Objectives:

1. Students will learn about the basic concepts in Organic Chemistry like the hybridisation in organic molecules, molecular interaction.
2. Students will briefly learn about the types of reaction, reactive intermediates and reaction mechanism in organic chemistry.
3. Students will learn how to name different classes of organic compounds using IUPAC nomenclature.
4. Students will learn how to represent 3 D of organic molecule on 2 D surfaces. Also how the orientation of a molecule in space can give a compound different reactivity.
5. Students will learn two important classes of organic compounds like alkanes and alkenes.
6. Develop skills to carry out related experiments.

Course Title: Concepts in Physical and Analytical Chemistry
Course Code: CHE-II. C-3
Course Objectives:

1. Will have knowledge of the main areas of Physical Chemistry, will develop critical thinking abilities and be able to work in chemical or related fields.
2. Will be able to understand the principles of titrimetric methods.
3. Attain practical skills in some classical and instrumental techniques.

Course Title: Concepts in Organic and Inorganic Chemistry
Course Code: CHE-II. C-4
Course Objectives:

1. Students will learn important classes of organic compound: Alkynes.
2. Students will briefly learn about the aromatic chemistry involving different types of reaction can aromatic compounds undergoes. Also they will learn about the mechanism involve in reactions having aromatic compounds.
3. Students will also learn chemistry of alcohols and alkyl halides
4. Will have an understanding of crystalline solids in terms of their structure, ionic radii and coordination there by able to predict crystal structure.

Course Title: Comprehensive Chemistry – I
Course Code: CHE- III. C-5
Course Objectives:
1. Will learn principles of Physical Chemistry and its applications in various processes.
2. Will obtain a comprehensive and detail understanding of the properties and compounds of the f-block elements i.e. the lanthanides and actinides.
3. Will gain a basic understanding of coordination compounds, their nomenclature and the types of coordination compounds.
4. Will be able to describe different crystal structures of ionic solids and the types of defects which can occur in a crystal.
5. Will be able to get a deeper understanding of the theory with practical knowledge.

Course Title: Name reactions and Synthetic methodologies
Course Code: CHE-III. E-1
Course Objectives:
1. Students will learn importance of name reactions in organic chemistry.
2. Students will learn different types of reactions in organic chemistry through name reactions.

Course Title: Surface Chemistry and Catalysis
Course Code: CHE- III. E-3
Course Objectives:
1. Will have an understanding of chemistry of surfaces and be able to interpret various types of adsorption.
2. Will understand the mechanism and applications of catalytic processes.
3. Will have practical knowledge of synthesis and characterisation of catalysts.

Course Title: Bioinorganic Chemistry
Course Code: CHE- III. E-4
Course Objectives:
1. To be proficient in the basic principles of bioinorganic chemistry and biochemistry.
2. Understand the role of metal ions that are involved in different processes like oxygen transport, electron-transfer reactions etc. in biological systems.
3. Summarize the role of metal centres in the metalloenzymes that are involved in the catalysis of various biological reactions.
4. Will develop practical skills to prepare model systems which mimic the role of metal ions in biological systems.

Course Title: Skill Development in Chemistry
Course Code: CHE.SEC-1
Course Objectives:
1. To understand the chemistry of fats, oils and the process involved in preparing soaps, detergents and disinfecting agents and provide necessary skills for the preparation.
2. To study the composition and chemical parameters of commonly consumed beverages like soft drinks and packed fruit juices, the process involved in their preservation and their long term effects on human health.

3. To study the various food additives like food colours, taste enhancers, preservatives, etc. and their effects on food and health. Food adulteration of commonly used kitchen ingredients like wheat, rice, dal, milk, butter, etc. and the tests involved to detect the adulterants will be studied.

Course Title: Comprehensive Chemistry-II
Course Code: CHE- IV. C- 6
Course Objectives:
Students will learn about;
1. Important classes of organic compounds include CHO elements.
2. Preparations involved in different classes of organic compound having CHO elements.
3. Important reaction involved in each class of included compounds.
4. Steps involved in an analytical procedure.
5. Sampling of solids, liquids and gases.
6. Statistical treatment of analytical data.

Course Title: Pharmaceutical Chemistry
Course Code: CHE-IV.E-5
Course Objectives:
1. Students will learn about important aspects with respect to pharmaceutical Chemistry.
2. Students will develop understanding in structure-activity relationship.
3. Students will learn efficient chemical synthesis involved in important drug.

Course Title: Polymer and Colloid Science
Course Code: CHE- IV. E-6
Course Objectives:
1. Will be able to classify colloids.
2. Will be able to calculate molar mass of polymers.
3. Will learn to synthesis some polymers in the laboratory

Course Title: Spectroscopic Techniques
Course Code: CHE-IV. E-7
Course Objectives:
On successful completion of the course, the student will be able to:
1. Will be able to understand the basic components of instruments and the choice of solvents for spectrometry.
2. Will be able to perform qualitative and quantitative analysis using principles of spectrometry.
3. Will be able to operate an UV-visible spectrophotometer.

Course Title: Plating and corrosion (Theory and Practicals) with effect from June 2020.
Course Code: CHE. SEC-2
Course Objectives:
1. Will learn principles of electroplating and its applications in various processes.
2. Will obtain a comprehensive and detail understanding of the principles of electroless plating.
3. Will be able to distinguish between various types of corrosion and calculate rate of corrosion.

Course Title: Advanced Chemistry I: Physical and Inorganic Chemistry
Course Code: CHE- V. C-7
Course Objectives:
1. Will have a working knowledge of the main areas of Physical Chemistry, will develop critical thinking abilities and be able to work in chemical or related fields.
2. Will help to get better understanding about the basics of Physical and Inorganic Chemistry.
3. Will be able to carry out experiments with required skills.

Course Title: Heterocyclic Chemistry
Course Code: CHE-V. E-9
Course Objectives:
1. Students will learn about important aspects with respect to heterocyclic chemistry.
2. Students will develop understanding with regards to reactivity of heterocyclic chemistry.
3. Students will learn efficient chemical synthesis involved in heterocyclic compounds.

Course Title: Nanomaterials and Solid State Chemistry
Course Code: CHE-V. E-10
Course Objectives:
1. Will be able to have a basic and concise knowledge of nanomaterials.
2. Will develop skills in nanomaterial synthesis.
3. Will be able to understand characterization techniques in solid state chemistry.

Course Title: Organometallic Chemistry
Course Code: CHE- V. E-11
Course Objectives:
1. Understand the basic principles of chemistry and molecular orbital theory with respect to chemical bonding.
2. To predict the structure and stability of organometallic cluster compounds based on the electron count and explain the chemical behavior and reactivity of organometallic compounds.
3. Describe and explain catalytic processes using an organometallic compound as a catalyst and explain how organometallic compounds are used as catalysts in organic synthesis.
4. Develop practical skills in the preparation of organometallic compounds and their precursors.

Course Title: Advanced Chemistry II: Organic and Analytical Chemistry
Course Code: CHE- VI. C-8
Course Objectives:
1. Will learn to write mechanisms with stereochemistry.
2. Will learn principles of separation and its applications.
3. Will have practical knowledge of chromatographic techniques.
4. Will be able to carry out experiments with required skills.

Course Title: Spectroscopic Methods in Organic Chemistry
Course Code: CHE-VI. E-13
Course Objectives:
1. Will be able to do spectral analysis of organic compounds.
2. Will learn theory of important spectroscopic techniques.
3. Will be able to elucidate structures of organic compounds based on spectral data.
4. Will be able to operate an UV-visible spectrometer

Course Title: Environmental Chemistry
Course Code: CHE-VI. E-14
Course Objectives:
The course provides understanding how:
1. Pollution affects our environment
2. Knowledge of chemistry can be used to solve problems.
3. Instrumental techniques can be used for chemical analysis of pollutants.

Course Title: Selected Topics in Inorganic Chemistry
Course Code: CHE- VI. E-15
Course Objectives:

1. Understand and integrate concepts relevant to graduate level Inorganic chemistry.
2. Acquire knowledge about the bond formation of compounds with special reference to MOT and CFT.
3. Determine the stability and instability of complexes using spectrophotometry.
4. Develop practical skills to carry out separation of metal ions by ion exchange method and analyze them using titrimetry or gravimetry.

9. **Course Learning Outcomes (CLOs)**

	Course Code	**Course Title**	**Course Learning Outcomes**
1.	CHE-I.C-1	General Physical and Inorganic Chemistry	**CLO1 :**Demonstrate and evaluate the rate and order of a reaction. **CLO2 :** Utilize mathematical concepts to solve chemical problems. **CLO 3 :**Develop expertise in the preparation of chemical solutions based on normality, molarity and molality. **CLO 4 :**Interpret the PV isotherms of gases and identify the critical temperature. **CLO 5 :** Delineate atomic structure, periodic table and covalent bonding. **CLO 6 :** Sketch hybridization and molecular orbital diagrams.
2.	CHE-I.C-2	General Organic and Inorganic Chemistry	On successful completion of the course, the student will be able to: **CLO 1 :** Name the organic compounds using IUPAC nomenclature. **CLO 2 :** Identify and classify the different organic reactions. **CLO 3 :** Apply the theoretical knowledge to synthesize alkanes and alkenes. **CLO 4 :** Write 3D structures of organic molecules using 2D surface. **CLO 5 :** Identify the given unknown organic compound (solid) by carrying out various chemical tests. **CLO6 :**Predict available oxidation states for s- and p-block elements. **CLO7 :**Identify which halides, oxides and hydrides are covalent, which are ionic, and why. **CLO8 :**Apply the knowledge of Normality and Molarity in preparation of different solutions.

3.	CHE-II.C-3	Concepts in Physical and Analytical Chemistry	On successful completion of the course, the student will be able to: **CLO1:** Describe the basic concepts of thermodynamics and its applications. **CLO2:** Interpret the pressure temperature diagrams in unary and binary systems. **CLO3 :** Explain the concept of surface tension and viscosity in liquids. **CLO4 :** Explain role of analytical chemistry in sciences, stoichiometric calculations and apply for numerical. **CLO5 :** Sketch titration curves and solve numerical. **CLO6 :** Explain theory on precipitation and complex formation titrations. **CLO7 :**Perform non-instrumental and instrumental quantitative analysis.
4.	CHE-II.C-4	Concepts in Organic and Inorganic chemistry	On successful completion of the course, the student will be able to: **CLO1 :** Categorize the compounds as aromatic, non-aromatic and anti-aromatic. **CLO2 :** Apply the theoretical knowledge to write the synthesis of alkynes, alkyl halides, aromatic compounds. **CLO3 :** Discuss and describe the steps involved in the mechanism of nitration, sulphonation, halogenation and Friedel Crafts reactions of aromatic compounds. **CLO4 :** Explain and outline the different properties of transition elements. **CLO5 :** Compare 4d and 5d analogues. **CLO6 :** Describe crystalline solids in terms of their structure, ionic radii and coordination and interpret crystal structures. **CLO7 :** Describe lattice energy, Born-Haber's cycle, Fajan's rule and defects in solids. **CLO8 :** Explain trends in periodic properties of d-block elements with respect to their ionic radii, oxidation state, spectral properties, magnetic properties. **CLO9 :** Describe crystalline solids in terms of their structure, ionic radii and coordination there by able to interpret crystal structure. **CLO10 :**Identify the given organic compounds (liquids) by carrying out various chemical tests.
5.	CHE-III.C-5	Comprehensive Chemistry-I (Physical & Inorganic Chemistry)	On successful completion of the course, the student will be able to: **CLO1 :** Understand Second and Third law of Thermodynamics **CLO2 :**Calculateequilibrium constant and

			formulate conditions for maximum yield in industrial processes **CLO3 :** Explain theory of strong and weak electrolytes. **CLO4 :** Explain trends in periodic properties of f-block elements with respect to its size of atoms or ions, reactivity, oxidation state, complex formation, colour, magnetic properties. **CLO5 :** Name coordination compounds and to able to draw the structure based on its name. **CLO6 :** Describe the shape and structures of coordination complexes based on different coordination numbers. **CLO7 :** Explain merits and demerits of different theories of acids and bases and to explain the properties of a solvent that determines their utility. **CLO8 :**Perform instrumental analysis. **CLO9 :**Perform synthesis and estimation of inorganic complexes.
6.	CHE-IV.C-6	Comprehensive Chemistry-II (Organic & Analytical Chemistry)	On successful completion of the course, the student will be able to: **CLO1 :** Identify and classify diverse organic compounds containing C, H and O elements. **CLO2 :** Predict the chemical reactivities of several organic compounds containing CHO elements. **CLO3 :** Outline the preparations of several compounds belonging to different classes of organic compounds having CHO elements. **CLO4 :** Apply the important reactions involved in each class of organic compounds with CHO elements. **CLO5 :** Design scheme for an analytical process. **CLO6 :** Use proper techniques of sampling of solids, liquids & gases. **CLO7 :** Apply statistical treatment to analytical data. **CLO8 :**Perform analytical procedures.
7.	CHE-V.C-7	Advanced Chemistry-I: Physical and Inorganic Chemistry	On successful completion of the course, the student will be able to: **CLO1:**Understand the interactions of electromagnetic radiation and matter in IR and Raman spectroscopy and their applications. **CLO2 :**Explain applications and harmful effects of nuclear radioisotopes. **CLO3 :**Demonstrate a sound knowledge of the photochemistry principles and their application. **CLO4 :**Employ the theories that govern metal ligand bonding. **CLO5 :** Interpret the types of crystal field splitting and calculate the crystal field

			stabilization energy. **CLO6 :**Discuss the types of d-d transitions and its theory. **CLO7:** Perform instrumental methods of analysis **CLO8 :** Synthesize and analyze complexes
8.	CHE-VI.C-8	Advanced Chemistry-II: Organic and Analytical chemistry	On successful completion of the course, the student will be able to: **CLO1 :** Assess conditions for obtaining maximum efficiency of extraction. **CLO2 :** Classify chromatographic methods. **CLO3 :** Apply chromatographic method for separation, qualitative and quantitative estimation. **CLO4 :** Predict the stereochemistry of products for various reactions using the mechanisms involved in the course. **CLO5 :** Explain the reactivity of organic compounds containing nitro, amino and cyano functional groups. **CLO6 :** Name and classify the carbohydrates and analyze its chemical reactivities. **CLO7 :** Name and classify the organosulfur and organophosphorous compounds and analyze its chemical reactivity. **CLO8 :**Perform qualitative and quantitative analysis based on theory.
9.	CHE-III.E-1	Name Reactions and Synthetic Methodologies	On successful completion of the course, the student will be able to: **CLO1 :** Describe condensation reactions involving nucleophilic addition to carbonyl compounds. **CLO2 :** Define and describe various name reactions and rearrangements along with their mechanisms. **CLO3 :** Predict the product for various reactions involving these name reactions/rearrangements. **CLO4 :** Apply these mechanisms towards the formation of complex molecules. **CLO5 :**Discuss and describe the steps involved in the mechanism of Friedel-Crafts reactions, Reimer-Tiemann reaction, Vilsmeier-Haack reaction, Gattermann-Koch reaction and Kolbe-Schmidt reaction. **CLO6 :** List the different oxidising and reducing agents. **CLO7 :** Apply the theoretical knowledge to identify the reagents used to bring about a particular chemical reaction. **CLO8:** Apply the theoretical knowledge during practical hours to prepare selected compounds.
10.	CHE-III.E-3	Surface Chemistry and	On successful completion of the course, the

		Catalysis	student will be able to: **CLO1 :**Describe the behavior of solid surfaces. **CLO2 :**Understand the concept of catalysts and catalysis. **CLO3 :**Classify and interpret various types of adsorption isotherms. **CLO4 :**Estimate surface area of a solid. **CLO5 :**Predict the mechanistic behavior of catalytic reactions. **CLO6 :**Evaluate conditions under which a catalysed reaction changes rate dependence. **CLO7 :**Synthesize and characterize catalysts.
11.	CHE-III.E-4	Bioinorganic Chemistry	On successful completion of the course, the student will be able to: **CLO1 :** Elucidate the role of metal ions that are involved in different processes like oxygen transport, electron-transfer reactions etc. in biological systems. **CLO2 :** Apply the concepts of coordination chemistry to metallobiomolecules which are based on iron and copper ions. **CLO3 :** Evaluate the role of metal centres in the metalloenzymes that are involved in the catalysis of various biological reactions and thus predict the reaction mechanisms. **CLO4 :** Develop skills to prepare model systems which mimic the role of metal ions in biological systems. **CLO5 :** Discuss the importance of essential and trace elements in biological processes and evaluate their role in biology. **CLO6 :** Explain the biologically important compounds like proteins, carbohydrates etc. and to interpret their biological importance. **CLO7 :** Compare different mechanisms of ion transport across cell membrane and classify different biomolecules which help in the transport of ions and to illustrate PS-I and PS-II approach of photosynthesis. **CLO8 :**Analyze how metals are used as diagnostic agents and application of Au, Cu, Zn, Pt-complexes as anti-cancer drug and inmedicine. **CLO9:** Synthesize and analyze complexes.
12.	CHE-IV.E-5	Pharmaceutical Chemistry	On successful completion of the course, the student will be able to: **CLO1:** Outline the significance of terminologies and regulation in Pharmaceutical chemistry. **CLO2:** Classify pharmacological drugs. **CLO3:** Understand the medicinal chemistry in plants.

			CLO4: Define and apply different types of chromatographic techniques in pharmaceutical industry. **CLO5:** Understand the working of quality control and quality. **CLO6:** Discuss Safety in Pharmaceutical laboratories. **CLO7:** Apply practical knowledge for the synthesis of some pharmaceutical drugs.
13.	CHE-IV.E-6	Polymer and Colloid Science	On successful completion of the course, the student will be able to: **CLO1:** Understand the colloidal state of matter **CLO2:** Evaluate properties of colloids. **CLO3:** Explain properties of gels and emulsions. **CLO4:** Calculate the molecular mass of polymer. **CLO5:** Understand solid state properties of polymers. **CLO6:** Design the synthesis of a polymer. **CLO7:** Synthesize and characterize colloids and determine molecular weight of polymer. **CLO8:** Distinguish between different types of solutions in terms of solute dimensions.
14.	CHE-IV.E-7	Spectroscopic Techniques	On successful completion of the course, the student will be able to: **CLO1:** Outline the Beer's Law, Lambert's law and interprets the deviation from Beer-Lambert's Law; to identify the validity and limitations of Beer-Lambert's Law. **CLO2:** Interpret the spectroscopic methods for qualitative and quantitative analysis; compare the colorimeter and spectrophotometer and employ the UV-Visible Spectrophotometer. **CLO3:** Outline the principle on which inductively coupled plasma spectroscopy works and illustrate the instrumentation involved in the technique. **CLO4:** Apply inductively coupled plasma spectroscopy technique and understand its limitations. **CLO5:**Perform qualitative and quantitative analysis based on absorbance measurements.
15.	CHE-V.E-9	Heterocyclic Chemistry	On successful completion of the course, the student will be able to: **CLO1 :** Identify, name and classify the various heterocyclic compounds. **CLO2 :** Describe the structure, different reactions and preparations of selected nitrogen and oxygen containing aliphatic heterocycles. **CLO3 :** Describe the structure, diverse reactions and syntheses of pyrrole, furan, thiophene and pyridine heterocycles.

			CLO4 : Describe the structure, diverse reactions and synthetic routes with mechanisms of numerous condensed heterocycles. **CLO5 :** Predict the reactivity of complex heterocyclic compounds containing the structural motif of these simple heterocycles. **CLO6 :** Apply the synthetic methodologies for the synthesis of complex heterocycles. **CLO7:** Apply practical knowledge for the synthesis of other heterocycles.
16.	CHE-V.E-10	Nanomaterials and Solid State Chemistry	On successful completion of the course, the student will be able to: **CLO1:** Recall the history, occurrence and technological development of nanomaterials and classify them. **CLO2:** Compare different synthesis techniques of nanoparticles like biological, chemical and physical and design various nanomaterials. **CLO3:** Evaluate XRD data, and calculate its parameters; carry out analysis of TG-DTA thermogram; assess morphology and particle size from SEM/TEM images. **CLO4:** Express the physical and chemical properties of solids like magnetic, electrical and dielectric which can be interpret the applications of materials in various field like catalysis, ferrofluids, etc. **CLO5:** Synthesize and characterize nanomaterials.
17.	CHE-V.E-11	Organometallic Chemistry	On successful completion of the course, the student will be able to: **CLO1 :** Illustrate metal-ligand interaction in formation of different metal carbonyls based on valence bond theory. **CLO2 :** Explain and rationalize the synthesis, structure, bonding, properties of organometallic compounds of main group elements. **CLO3 :** Apply the EAN concept and Wade's rules to any organometallic system and predict its stability, structure and bonding. **CLO4 :** Understand the chemical behavior and predict the reaction mechanism of organometallic compounds. **CLO5 :** Illustrate the catalytic cycles using an organometallic compound as a catalyst for industrial synthesis of some organic compounds. **CLO6 :**Carry out synthesis of organometallic compounds andInterpret IR spectra of metal carbonyls and predict their structure.
18.	CHE-VI.E-13	Spectroscopic Methods	On successful completion of the course, the

		in Organic Chemistry	student will be able to: **CLO1:** Describe the principles of IR, UV and Mass spectrometry. **CLO2:** Calculate UV maxima of any given organic compound using Woodward-Fieser rules. **CLO3:** Predict the presence of various functional groups in a given organic compound using IR spectroscopy. **CLO4:** Interpret the mass spectra of various organic compounds. **CLO5:** Predict the structures of organic compounds based on the given ^{1}H NMR and ^{13}CMR data. **CLO6:** Interpret the ^{1}H NMR and ^{13}CMR spectra of organic compounds.
19.	CHE-VI.E-14	Environmental Chemistry	On successful completion of the course, the student will be able to: **CLO1:** Delineate how pollutants are transported and accumulated in the environment. **CLO2:** Recognize different types of toxic substances and analyze toxicology. **CLO3:** Describe water purification and waste treatment processes. **CLO4 :**Apply knowledge of chemical and biochemical principles of fundamental environmental processes in air, water, and soil. **CLO5 :** Apply basic chemical concepts to analyze chemical processes involved in different environmental problems. **CLO6 :**Develop skills in procedures and few instrumental methods applied in analysis of soil and water pollution.
20.	CHE-VI.E-15	Selected Topics in Inorganic Chemistry	On successful completion of the course, the student will be able to: **CLO1:** Differentiate between thermodynamic stability and kinetic stability and apply it to transition metal complexes. **CLO2:** Apply the concepts to determine the reaction mechanism of transition metal complexes. **CLO3:** Determine the factors that govern the stability and lability of transition metal complexes. **CLO4:** Understand the chemistry and function of some of the technologically useful materials like liquid crystals, superconductors and fullerides. **CLO5:** Discuss what are polymers and their properties, to classify the polymers (based on coordination, addition and condensation reaction). **CLO6:** Illustrate the preparation, structure and

			bonding and applications of polymers comprising of B, P, Si and S. **CLO7:** Analyze the magnetic properties of the transition metal complexes as well as interpret the effect of temperature on magnetic properties. **CLO8:** Explain Guoy's balance for determining the magnetic susceptibility. **CLO9:** Identify and apply the symmetry elements in molecules and to evaluate the Point groups and symmetry elements in molecules with appropriate examples. **CLO10:** Carry out separation and estimation of ions from compounds.
21.	CHE.SEC-1	Skill Development in Chemistry	On successful completion of the course the students will be able to: **CLO1:** Determine the saponification value, iodine value and acid values of oils and test the adulterants in food items. **CLO2:** Apply the skills for the preparation of white phenyl and liquid soap. **CLO3:** Apply the knowledge for the safe disposal of white phenyl. **CLO4:** Understand chemistry of soaps, synthetic detergents, alkyl and aryl sulphonates and floor cleaners. **CLO5:** Determine the pH of soft drinks and other beverages. **CLO6:** Understand chemistry of food additives and adulterants and apply the knowledge for detecting and testing foods items for adulterants.
22.	CHE.SEC-2	Plating and corrosion	On successful completion of the course, the student will be able to: **CLO1:** Understand principles of electroplating. **CLO2:** Design bath for electroplating. **CLO3:** Formulate ideal conditions for electroless plating. **CLO4:** Perform electroless plating. **CLO5:** Identify types of corrosion. **CLO6:** Calculate rate of corrosion.

10. Teaching-Learning-Evaluation Pedagogies

11. Activities of the Department

12. Course Syllabus: Click Here

13. Learning Outcome Matrix

MATRIX -1
MAPPING COURSES/ACTIVITIES TO PROGRAMME LEARNING OUTCOME
PROGRAMME: B.Sc Chemistry

(use ☑ if linked, ☒ if not linked)

PLOS / Course /Activity		PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communica a & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
Courses Component A	CHE-I. C-1	☒	☒	☑	☑	☑	☑	☑	☑	☒	☒
	CHE-I. C-2	☑	☑	☑	☑	☑	☒	☑	☑	☑	☒
	CHE-II. C-3	☑	☑	☑	☑	☑	☑	☑	☑	☑	☒
	CHE-II. C-4	☑	☑	☑	☑	☑	☒	☑	☑	☑	☒
	CHE-III. C-5	☑	☒	☑	☑	☑	☑	☑	☑	☑	☒
	CHE-III. E-1	☑	☑	☑	☑	☑	☒	☑	☑	☑	☒
	CHE-III. E-3	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
	CHE-III. E-4	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
	CHE-IV.C-6	☑	☑	☑	☑	☑	☑	☑	☑	☑	☒
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	CHE-IV. E-6	☑	☒	☑	☑	☑	☑	☑	☑	☒	☑
	CHE-IV. E-7	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
	CHE-V. C-7	☑	☑	☑	☑	☑	☑	☑	☑	☑	☒
	CHE-V. E-9	☑	☒	☑	☑	☑	☒	☑	☑	☒	☒
	CHE-V. E-10	☑	☑	☑	☑	☑	☒	☑	☑	☑	☑
	CHE-V.	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

	E-11										
	CHE-VI. C-8	☑	☒	☑	☑	☑	☒	☑	☑	☒	☑
	CHE-VI. E-13	☑	☒	☑	☑	☒	☒	☑	☑	☒	☑
	CHE-VI. E-14	☒	☑	☒	☒	☑	☑	☑	☑	☑	☒
	CHE-VI. E-15	☑	☑	☑	☑	☑	☑	☑	☑	☑	☒
Courses Component B	**Language**										
	Academic Writing										
	Research Writing										
	Statistical methods										
	EVS										
	CHE.SEC-01	☑	☑	☑	☑	☑	☑	☑	☑	☑	☒
	CHE.SEC-2	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
	Sports /NSS /NCC/ SE/OP										
Component C	**Internship**	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Component D	**…. *Add***										
Activities of the department	**…. *Add***										
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MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Core*

Course Code: CHE-I. C-1

Course Title: General Physical and Inorganic Chemistry

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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* To Refer CLO's Click here

MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Core*

Course Code: CHE-I. C-2

Course Title: General Organic and Inorganic Chemistry

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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* To Refer CLO's Click here

MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Core*

Course Code: CHE-II. C-3

Course Title: Concepts in Physical and Analytical Chemistry

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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* To Refer CLO's Click here

MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Core*

Course Code: CHE-II. C-4
Course Title: Concepts in Organic and Inorganic Chemistry

(use ☑ if linked, ☒ if not linked)

	PLO-1: Use of	PLO-2 : Environ	PLO -3: Individual	PLO-4:	PLO-5: Acquire	PLO-6: Handle	PLO-7:	PLO-08: Operate	PLO-09: Apprecia	PLO-10: Elucidate

PLOs CLOs	Technology, Problem Analysis and Solutions	ment Sustainability & Ethics & Social responsibility	and Team work, Communicationa & Life Skills	Research Aptitude	the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	te the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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* To Refer CLO's Click here

MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *(GEC/ SEC/ DSE/ Core)* **Core**

Course Code: CHE-II. C-5

Course Title: Comprehensive Chemistry –I (Physical & Inorganic Chemistry)

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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* To Refer CLO's Click here

MATRIX -2 *(Course-wise)*

MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme:B. Sc.
Type of Course: *Elective*
Course Code:CHE-III.E-1
Course Title: Name reactions and synthetic methodologies

(use ☑ if linked, ☒ if not linked)

PLOs CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO - 3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/ TEM images.
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* To Refer CLO's Click here

MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Elective*

Course Code: CHE-III. E-3
Course Title: Surface Chemistry and Catalysis
(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	**PLO-1: Use of Technology, Problem Analysis and Solutions**	**PLO-2 : Environment Sustainability & Ethics & Social responsibility**	**PLO -3: Individual and Team work, Communicationa & Life Skills**	**PLO-4: Research Aptitude**	**PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.**	**PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.**	**PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research**	**PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting**	**PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.**	**PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.**
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* To Refer CLO's Click here

MATRIX -2 *(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Elective*

Course Code: CHE-III. E-4
Course Title: Bioinorganic Chemistry

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	**PLO-1: Use of Technology, Problem Analysis and Solutions**	**PLO-2 : Environment Sustainability & Ethics & Social responsibility**	**PLO -3: Individual and Team work, Communicationa & Life Skills**	**PLO-4: Research Aptitude**	**PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.**	**PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.**	**PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research**	**PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting**	**PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.**	**PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.**
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* To Refer CLO's Click here

MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *SEC*

Course Code: CHE.SEC-1
Course Title: Skill Development in Chemistry

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	**PLO-1: Use of Technology, Problem Analysis and Solutions**	**PLO-2 : Environment Sustainability & Ethics & Social responsibility**	**PLO -3: Individual and Team work, Communicationa & Life Skills**	**PLO-4: Research Aptitude**	**PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.**	**PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.**	**PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research**	**PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting**	**PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.**	**PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.**
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* To Refer CLO's Click here

MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Core*

Course Code: CHE-IV. C-6
Course Title: Comprehensive Chemistry –II (Organic and Analytical Chemistry)

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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* To Refer CLO's Click here

MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Elective*

Course Code: CHE-IV. E-5
Course Title Pharmaceutical Chemistry

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	**PLO-1: Use of Technology, Problem Analysis and Solutions**	**PLO-2 : Environment Sustainability & Ethics & Social responsibility**	**PLO -3: Individual and Team work, Communicationa & Life Skills**	**PLO-4: Research Aptitude**	**PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.**	**PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.**	**PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research**	**PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting**	**PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.**	**PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.**
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* To Refer CLO's Click here

MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Elective*

Course Code: CHE-IV. E-6
Course Title: Polymer and Colloid Science

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	**PLO-1: Use of Technology, Problem Analysis and Solutions**	**PLO-2 : Environment Sustainability & Ethics & Social responsibility**	**PLO -3: Individual and Team work, Communicationa & Life Skills**	**PLO-4: Research Aptitude**	**PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.**	**PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.**	**PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research**	**PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting**	**PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.**	**PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.**
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MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Elective*

Course Code: CHE-IV. E-7
Course Title: Spectroscopic Techniques

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	**PLO-1: Use of Technology, Problem Analysis and Solutions**	**PLO-2 : Environment Sustainability & Ethics & Social responsibility**	**PLO -3: Individual and Team work, Communicationa & Life Skills**	**PLO-4: Research Aptitude**	**PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.**	**PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.**	**PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research**	**PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting**	**PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.**	**PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.**
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MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *SEC*

Course Code: CHE. SEC-2
Course Title: Plating and corrosion

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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* To Refer CLO's Click here

MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Core*

Course Code: CHE-V. C-7
Course Title: Advanced Chemistry – I (Physical & Inorganic Chemistry)

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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* To Refer CLO's Click here

MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *ELECTIVE*

Course Code: CHE-V. E-9
Course Title: Heterocyclic Chemistry

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *ELECTIVE*

Course Code: CHE-V. E-10
Course Title: Nanomaterials and Solid State Chemistry

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *ELECTIVE*

Course Code: CHE-V. E-11
Course Title: Organometallic Chemistry

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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MATRIX -2*(Course-wise)*
MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Core*

Course Code: CHE-VI. C-8
Course Title: Advanced Chemistry – II (Organic and Analytical chemistry)

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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MATRIX -2*(Course-wise)*

MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Elective*

Course Code: CHE-VI. E-13

Course Title: Spectroscopic Methods in Organic Chemistry

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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MATRIX -2*(Course-wise)*

MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Elective*

Course Code: CHE-VI. E-14

Course Title: Environmental Chemistry

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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MATRIX -2*(Course-wise)*

MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course: *Elective*

Course Code: CHE-VI. E-15

Course Title: Selected Topics in Inorganic Chemistry

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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MATRIX -2*(Course-wise)*

MAPPING OF PROGRAMME LEARNING OUTCOME TO COURSE LEARNING OUTCOMES

Programme: B.Sc

Type of Course:

Course Code:

Course Title: Project

(use ☑ if linked, ☒ if not linked)

PLOs / CLOs	PLO-1: Use of Technology, Problem Analysis and Solutions	PLO-2 : Environment Sustainability & Ethics & Social responsibility	PLO -3: Individual and Team work, Communicationa & Life Skills	PLO-4: Research Aptitude	PLO-5: Acquire the skills in preparation of chemical solutions, inorganic complexes, planning the procedures and performing experiments in the laboratory.	PLO-6: Handle scientific instruments like spectrophotometer, pH meter, Conductometer, Potentiometer, etc.	PLO-7: Develop basic theoretical principles of chemistry and writing skills applicable for higher studies and research	PLO-08: Operate efficiently within a group during their project and assignments and hence develop important skills such as communication, negotiation, influence, advising and interpreting	PLO-09: Appreciate the central role of chemistry in our society by understanding the safe handling of chemicals, environmental issues and key issues faced in energy, health and medicine.	PLO-10: Elucidate various spectra, X Ray Diffractograms, TG-DTA curves and identify surface morphology by SEM/TEM images.
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Matrix-3:

Matrix-4:

14.Question bank: