Programme: M.Sc. (Chemistry)(Two-year degree programme)

PROGRAMME OUTCOMES (POs)

PO 1: Provide platform for the understanding of concepts, principles, theories and mechanisms related to chemistry.

PO 2: Identifying and analyzing complex problems using research-based knowledge including design of experiments, analysis and interpretation of data.

PO 3: Develop skills for chemical tools/softwares required for the investigation and interpretation of data.

PO 4: Create awareness about the impact of chemical processes on society and environment along with the need for sustainable development.

PO 5: Motivation and support for research with special focus on interdisciplinary research.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: To clearly understand the concepts and applications in the field of Chemistry, environment alongwith computer applications.

PSO 2: Students will be able to grasp the technological advancements in the usage of chemistry to analyse and design techniques/methods for variety of applications.

PSO 3: Enable students for placement opportunities and to pursue career in an interdisciplinary areas in India as well as abroad.

PSO 4: Students will be able to develop and demonstrate knowledge of statistical tools used in chemistry.

PSO 5: Learners can also acquire practical skills to work as chemist, faculty and other industrial supporting services.

M.Sc. Chemistry First Semester	
Course	**Course Outcomes (COs)**
Basic Analytical Chemistry (CHEM-511)	**CO 1:** Describe and compare a range of analytical chemistry methods and explain the underlying theoretical principles; **CO 2**:Explain the broad role of analysts in quality control and assessment of experimental measurements from various application contexts; **CO 3:** Employ a variety of analytical methods to prepare, separate and characterise samples from various matrices; **CO 4:** As part of a team or individually, conduct, analyse and interpret results of a chemical analysis and effectively communicate these in written reports and other formats; **CO 5:** Work safely and competently in an analytical laboratory setting.
Organo Transition Metal Chemistry and Inorganic Polymers(CHEM-512)	**CO1:** Understand the reaction pathways of substitution, oxidative addition, reductive elimination, insertion and elimination reactions. **CO2:** To learn the importance of homogeneous and heterogeneous catalysts in industrially accepted reactions. **CO3:** To know the role of transition metal catalysts in various oxidation reactions and phase transfer catalysis. **CO4:** Acquire the knowledge for the synthesis, properties and applications of polyphosphazenes, polysiloxanes and polsilanes.
Quantum Chemistry(CHEM-514)	**CO1:** To learn importance of quantum mechanics, failure of classical concepts and some important basic principles of quantum mechanics. **CO2:** To understand the behaviour of particle in one and three dimensional box with translational energy, energy levels, quantization of energy and applications of particle in a box model. **CO3:** To learn about angular momentum, approximate Methods, operators used in quantum mechanics. **CO4:** Developing understanding for Valence-bond and molecular orbital approaches, electronic structures and pi-electron approximation.

Organic Chemistry(CHEM-517)	**CO 1:** Understand the difference among aromatic, non-aromatic and anti-aromatic compounds along with basic mechanistic kinetic concepts. **CO 2:** Develop the understanding regarding stability and reactivity of reaction intermediates accompanied by chemistry of elimination reactions. **CO 3:** To learn the chemistry pertaining to aromatic nucleophilic and electrophilic substitutions. **CO 4:** To know the basic concepts and mechanisms related to aliphatic nucleophilic substitutions.
Solid State Chemistry (CHEM-518)	**CO1:** To learn importance of X-ray Diffraction for Crystal Structure **CO2:** To understand bonding in crystals, Band theory and Imperfections in crystal structures. **CO3:** To learn about Properties of crystals like thermal properties and optical properties. **CO4:** Developing understanding for general principles, experimental procedures, kinetics of solid state reactions.
Fundamental and Applications of Computers in chemistry(CSE-544)	**CO1:** Understanding general about computers and Computer programming with application in chemistry and solving problems using computer programs. **CO2:** Learning basic structure and functioning of a computer, memory, architecture, I/O devices, etc. Familiarity with a computer. **CO3:** Learning computer languages: Opening editing, Compiling a file and running a programme. **CO4:** Enable students to be able to draw plots by using computer programming.
Computational Biology and Biostatistics(BT-505)	**CO 1:** To learn the introduction and concepts related to biostatics. **CO 2**: To know the significance of tests based on Z, χ^2, t and F statistics.

	CO 3: To understand the basics and principles of biological and chemical databases. **CO 4:** To understand the principles involved in global and multiple sequence alignment. **CO 5**: To learn the gene finding algorithms and softwares for proteins.
Practical(CHEM-516)	**CO 1:** To understand the techniques used for gravimetric estimations and apply them in experiments. **CO2: E**xperimental learning of two and three step organic reactions**.** **CO3:** Adequate understanding and practice of physical parameters determination such as viscosity, surface tension, solubility and density.
M.Sc. Chemistry Second Semester	
Organic Spectroscopy(CHEM-526)	**CO 1:** To learn the basic concepts and techniques involved in IR spectroscopy. **CO2:** Understanding the importance of UV-Vis spectroscopy and its application in the study of organic compounds. **CO 3:** To develop the understanding of 1H and C13 NMR along with its applications. **CO 4:** To learn the principles and related mechanisms of mass spectroscopy.
Bioinorganic Chemistry(CHEM-522)	**CO 1:** To understand and compare the fundamentals and principles of bio-inorganic chemistry related to elementary cell biology. **CO 2**: To know the role of different vitamins in the living beings followed by the merits and demerits of metals in medicine. **CO 3:** To comprehend the properties of metalloenezymes and mechanism of photosynthesis. **CO 4**: To understand the principles, mechanisms and importance of nitrogen fixation, nitrogenise enzymes, Nitrite reductase, nitrate reductase, nitrogen cycle and sulphur cycle.
	CO 1 : To understand the fundamentals of amino acids and nucleic acids.

Bioorganic Chemistry(CHEM-523)	**CO 2** : To learn the various principles and mechanisms involved in metabolism and metabolic reactions. **CO 3:** To know the importance and mechanism of fatty acids and lipids. **CO 4:** To describe the preparation, properties and application of soaps and to explain the structure and importance of DNA and RNA ; **CO 5**: To develop the understanding related to chemical and enzymatic hydrolysis of nucleic acids, waxes and soaps.
Disconnection Approach in Organic Synthesis(CHEM-527)	**CO1:** To know the application of stereochemistry in organic synthesis. **CO2:** To understand the use and application of disconnection approach for organic synthesis. **CO3:** Learner will know the basic principles of green chemistry and application of non-conventional techniques in organic synthesis **CO4:** To learn general synthesis of compounds with three or more heteroatoms in the ring
Practicals (CHEM-525)	**CO 1:** To learn the measurements techniques involved in refractive index, conductometry, partition co-efficient and adsorption. **CO 2:** Learn the methods for the preparation and estimation of colloidal solution and thermochemistry experiments. **CO 3:** Experimental learning of multistep organic synthesis along with with spectroscopic problems.
Computational Chemistry Lab (CHEM-529)	**CO 1:** To learn the working of basic software used in chemistry. **CO 2:** To get equipped with MS-Word. Power point, excel and statistical plotting. **CO 3:** Learn to use the internet facility in the best possible way for research.

Credit Seminar(CHEM-591)	**CO1:** Learning how to pick a problem for their research project and provide latest facts and updated information by consulting latest editions of textbooks, reference books, monographs and peer-reviewed national & international research journals.
M.Sc. Chemistry Third Semester	
Research Methodology(CHEM-599)	**CO 1:** The students would learn about various research methods used in research. **CO 2:** To know how to do survey of literature in specific field and how to write synopsis for research proposal. **CO 3:** To understand research as career; current status and future prospects of a specific research field. **CO 4:** To learn experimental designs, sampling designs, recording of observation, measurement and scaling techniques.
Main Group Chemistry and Inorganic photochemistry(CHEM-531)	**CO 1:** Describe and compare a range of inorganic photochemistry and main group chemistry fundamentals and explain the underlying theoretical principles; **CO 2** :Explain the broad role of photochemistry in quality control and assessment of experimental measurements from various application contexts; **CO3:** Employ a variety of analytical methods to prepare, separate and characterise samples from various matrices; **CO 4:** As part of a team or individually, conduct, analyse and interpret results of a chemical analysis and effectively communicate these in written reports and other formats; **CO 5:** Work safely and competently in an inorganic laboratory setting.
Natural Products(CHEM-537)	**CO 1:** To learn the classification and methods for structure determination of terpenoids and carotenoids. **CO 2:** To understand the basics, stereochemistry and structure determination of steroids **CO 3:** To Develop the understanding regarding structure elucidation and classification of alkaloids.

	CO 4: To study the synthesis of vitamins and antibiotics.
(CHEM-533) Advanced Statistical Thermodynamics and Symmetry	**CO 1:** To understand the basics and laws pertaining to ideal gases. **CO 2:** To get familiarize with the statistical basis of thermodynamics. **CO 3:** To develop the understanding of thermodynamic properties of molecules from partition function. **CO 4:** To know the symmetry elements and symmetry operations involved in group theory.
Current Trends in Organic Synthesis(CHEM-535)	**CO 1:** To understand the classification, concepts and chemistry of pericyclic reactions. **CO 2:** Learn the basic principles of photochemistry along with the photochemistry of alkenes, aromatic and carbonyl compounds. **CO 3:** To develop the understanding of the chemistry of Aziridines, Azetidines, Indoles and azoles. **CO 4:** Get familiarize with the preparation and applications of some reagents and reactions with mechanistic details.
Practicals (CHEM-538)	**CO 1:** To learn the skills for the separation and purification of organic compounds followed by the characterization. **CO 2:** Experimental learning of some name reactions used in organic synthesis.
Dissertation (Lit. Search, Synopsis) (CHEM-600)	**CO 1:** Learning how to pick a problem for their research project and to provide latest facts and updated information by consulting latest editions of textbooks, reference books, monographs and peer-reviewed national & international research journals.
M.Sc. Chemistry Fourth Semester	
Dissertation (Experimental, writing) (CHEM-600*)	**CO 1:** Students will learn how to work on a research topic assigned to him/her by their supervisor/mentor with a

	purpose to develop a collective approach to study, analyze and solve the problem.