Department:- M.Sc. NEP (Analytical Chemistry)

Programme Outcomes (POs)

PO-1	Be acquainted with the fundamentals and practical applications of chemistry.
PO-2	Be capable of utilizing their knowledge in their social, professional, and personal spheres.
PO-3	Have the skills necessary to pursue a career in chemistry or research.
PO-4	Possess the expertise and self-assurance necessary to pursue further chemistry education.
PO-5	Possess skill in laboratory procedures and instrument management
PO-6	Grow environmentally conscious and engage in constructive national citizenship.

Programme Specific Outcomes (PSOs)

PSO-1	To gain knowledge in chemistry, scrutinize and accomplish solution to problems encountered in the field of research and analysis.
PSO-2	To apply the basic knowledge of chemistry to perform various tasks at the workplace to meet global standards.
PSO-3	To deduce qualitative and quantitative information using various analytical technique.
PSO-4	To inculcate the aptitude of scientific approach along with analytical reasoning in technologies used in the Industry.
PSO-5	To explicit subject knowledge and integrate it in interdisciplinary research.
PSO-6	To understand, manage and contribute to solve societal and environmental issues ethically.
PSO-7	To exhibit professional work ethics and norms of scientific developments.
PSO-8	To develop critical thinking approach toward the scientific problems, analysis, validation and documentation with safety norms and standards.
PSO-9	To inculcate analytical thinking,so that students will have an edge for a better future in chemical industries.
PSO-10	To imbibe an attitude of lifelong learning so as to thrive in knowledge and skills.

Course Outcomes (COs)

SEMESTER-I

COURSE CODE: PSCH101
COURSE NAME: CHEMISTRY PAPER I (Physical Chemistry)

After successful completion of this course, students will be able to:	
CO-1	The learners will apply the advanced thermodynamics, Maxwell equation and its applications to ideal gases.
CO-2	The learners evaluate the different theories of chemical kinetics and effect of temperature on reaction rates.
CO-3	The learners will implement the applications of chemical thermodynamics to real gases, solutions, surfaces and their energetics.
CO-4	e learners will evaluate the resting membrane potential by using the conceptof bio electrochemistry learners will evaluate the resting membrane potential by using the conceptof bio electrochemistry
O-5 -5 5	The learners will try to accomplish a solution to problems encountered in the field of research learners will try to accomplish a solution to problems encountered in the field of research
O-6 -6 6	The learners will understand the applications of operators and Schrodinger equation in the field of quantum Chemistry. learners will understand the applications of operators and Schrodinger equation in the field of quantum Chemistry.

COURSE CODE: PSCH102

COURSE NAME: CHEMISTRY PAPER II (Inorganic Chemistry)

After successful completion of this course, students will be able to:	
CO-1	The learner will be able to express the derivations of wave equation and concept of MOT applied to diatomic & polyatomic molecules.
CO-2	The learner will be able to systematically classify the molecules on the basis of Group theory and comprehend its applications in explaining symmetry adapted linear combinations.
CO-3	Elucidate the structures of inorganic compounds and know the wide applications of solid state lasers.
CO-4	Represent schematically Orgel and Tanabe Sugano diagrams, splitting of terms in octahedral environment
CO-5	Calculate electron parameters with respect to inorganic complexes.

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COURSE CODE: PSCH103

COURSE NAME: CHEMISTRY PAPER III (Organic Chemistry)

After successful completion of this course, students will be able to:	
CO-1	Predict the reactivity of organic compound from its structure.
CO-2	Understand different methods used for determination of Organic ReactionMechanism
CO-3	Understand the fundamental concept in stereochemistry by applying varioussymmetry elements of organic molecule.
CO-4	Acquire the knowledge of chirality by taking examples of symmetrical andunsymmetrical molecule
CO-5	Develop interest in stereochemistry by studying stereo chemical features ofdifferent classes of organic compounds
CO-6	Identify the nomenclature of various stereo chemical phenomena .
CO-7	Organize the techniques of aromatic nucleophile substitution reactions for synthesizing/transforming molecules.
CO-8	Organize the techniques of aromatic nucleophile substitution reactions forsynthesizing/transforming molecules.

CO-9	Organize the techniques of aromatic nucleophile substitution reactions forsynthesizing/transforming molecules.

CO-10	Understand the concept of aromaticity and to know the nature of bonds, electronic effects and other properties of molecules.

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COURSE CODE: PSCH104

COURSE NAME: CHEMISTRY PAPER IV (Analytical Chemistry)

After successful completion of this course, students will be able to:	
CO-1	Understand various terms used in analytical chemistry.
CO-2	Identify the different types of errors in analysis.
CO-3	Sketch out the role and importance of total quality management, safety, accreditations and GLP in industries.
CO-4	Understand the efficacy of automation in chemical analysis.
CO-5	Design and specify applications of advanced analytical techniques in various fields.
CO-6	Explore the applications of IR spectroscopy and thermal methods.
CO-7	Perform basic calculations required in chemical analysis.
CO-8	Interpret the experimental results of analytical techniques.

COURSE CODE: CHEM506

COURSE NAME: CHEMISTRY PAPER (Research methodology)

After successful completion of this course, students will be able to:	
CO-1	To enable the student to be able to extract information from journals and digital resources.
CO-2	Understanding tools to analyse the data, writing and presenting scientific paper.
CO-3	Safe working procedure and ethical handling of chemicals.
CO-4	Describe research, identification of research problems, and preparation of proposals.
CO-5	Practice ethics in all the domains of research.
CO-6	Analyze the results using mathematical and statistical tools.

SEMESTER II

COURSE CODE: CHEM-507

COURSE NAME: Physical CHEMISTRY

After successful completion of this course, students will be able to:	
CO-1	To learn the concept of quantum chemistry and able to solve problems related to 1D box, 2D box, 3D box and to explain the role of operators in quantum chemistry.
CO-2	To understand the use of Schrodinger wave equation in one and two electron systems along with applications of HMO.
CO-3	To develop the skill to solve the problems based on chemical thermodynamics, molecular dynamics and quantum Chemistry.
CO-4	To apply the concept of Jablonski mechanism in photochemical reactions.
CO-5	Learners will get knowledge of advanced chemical kinetics and molecular dynamics.

COURSE CODE: CHEM50811/ CHEM50812

COURSE NAME: Inorganic chemistry

After successful completion of this course, students will be able to:	
CO-1	Elucidate on the rate, mechanism of inorganic reactions including substitution, redox and isomerization reactions and on the methods ofdetermination of rate of reactions.
CO-2	Debate on toxicity of heavy metals, specific case studies and theeffect of interaction of radiation with the environment.
CO-3	Compare the stability of complexes elaborate different methods of preparation and analyze structure and bonding..
CO-4	To infer role of biological oxygen carriers, copper containing enzymes and nitrogen fixing enzymes in biological systems

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COURSE CODE: CHEM 509

COURSE NAME: Organic chemistry

After successful completion of this course, students will be able to:	
CO-1	Recognize the type of mechanism & intermediates involved in the given organic reaction and to prove mechanism for the reaction..
CO-2	Identify the ways to modify aliphatic and aromatic compounds via Nucleophilic substitution reactions.
CO-3	Predict the mechanism and stereochemistry of important organic reactions.
CO-4	Understand and write the mechanism of rearrangement reactions with stereochemistry and its applications.
CO-5	Understand the HOMO-LUMO concept and it significance in organic chemistry.
CO-6	Understand the basic principle and concepts in UV and IR spectroscopy
CO-7	Understand how ^{1}H, ^{13}C NMR and Mass spectroscopy are important for the structure determination of organic compounds.
CO-8	Understand the basic concepts of ^{1}H, ^{13}C NMR, and massspectroscopy

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COURSE CODE: CHEM 510

COURSE NAME: Analytical Chemistry

After successful completion of this course, students will be able to:	
CO-1	Able to compare the advantages/disadvantages of SEM, STM and TEM.
CO-2	Able to develop different techniques to separate the components of mixture.
CO-3	Conversant with basic principles and theories of mass spectrometry
CO-4	Able to apply the electro analytical methods to sample under consideration.
CO-5	Able to elaborate on electrogravimetry and coulometry techniques.

Programme Specific Outcomes (PSOs)

PSO-1	Gain knowledge of the advanced concepts in the branch of chemistry, scrutinize and accomplish a solution to problems encountered in the field of research and analysis.
PSO-2	Apply the basic knowledge of chemistry to perform various tasks assigned to them at the workplace in industry and academia to meet the global standards.
PSO-3	Deduce qualitative and quantitative information of chemical compounds using advanced spectroscopic methods which can further be analyzed using practical skills inculcated in them during the course.
PSO-4	Imbibe the attitude as well as aptitude of a scientific approach along with analytical reasoning with respect to the novel techniques actually implemented in the industry..
PSO-5	Use the subject knowledge, communication and ICT skills to become an effective team leader/team member in the interdisciplinary fields.
PSO-6	Understand, Manage and contribute to solve basic societal issues and environmental concerns ethically based on principles of scientific knowledge gained.
PSO-7	Exhibit professional work ethics and norms of scientific development.

MSc. II (Analytical chemistry)

COURSE CODE: Course Code: CHEM661

COURSE NAME: CHEMISTRY PAPER I (QUALITY IN ANALYTICAL CHEMISTRY – I)

After successful completion of this course, students will be able to:	
CO-1	Validate sampling in chemical and pharmaceutical industries .
CO-2	Operate basic analytical techniques, develop problem solving skills and be familiar with good laboratory practice.
CO-3	Optimize the variables that affect the choice of analytical techniques in chemical analysis.
CO-4	Apply different type of chromatographic techniques to determine, identify and characterize chemical compounds

COURSE CODE: CHEM 662

COURSE NAME: CHEMISTRY PAPER II (ADVANCED INSTRUMENTAL TECHNIQUES- I)

After successful completion of this course, students will be able to:	
CO-1	Theoretical principles, instrumentation and applications of surface analytical techniques. CLO2. CLO3 CLO4.
CO-2	Basic instrumentation of ESR, Mossbauer's Spectroscopy and Atomic Emission spectroscopy.
CO-3	Principle, working, instrumentation and applications of different Electro analytical methods.
CO-4	principle, instrumentation and applications of various sophisticated analytical instruments

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COURSE CODE: CHEM 663

COURSE NAME: CHEMISTRY PAPER III (BIOANALYTICAL CHEMISTRY AND FOOD ANALYSIS)

After successful completion of this course, students will be able to:	
CO-1	Explain the nutritional value of vitamins and minerals .
CO-2	Explain the method of determination of enzymes, carbohydrates and proteins
CO-3	Explain the procedure for analyzing the food samples and to identify the presence of adulterants, contaminants, and pesticide residues
CO-4	Assess the safety and quality of food products based on their analytical results.
CO-5	Evaluate the impact of processing on food components and make judgments regarding the suitability of food additives in various products

COURSE CODE: : CHEM 66511/ PRCHEM 66511

COURSE NAME: CHEMISTRY PAPER IV (ENVIRONMENTAL AND CERTAIN INDUSTRIALLY IMPORTANT MATERIAL)

After successful completion of this course, students will be able to:	
CO-1	Apply the knowledge gained to minimize pollution and improve the quality of the environment. CLO2. CLO3. CLO4.
CO-2	Assess the pollution level in environment.
CO-3	Contribute in conducting environmental audit.
CO-4	Apply different environmental laws as per situation.
CO-5	Decide the suitable analytical method for the analysis of the soil and water sample.
CO-6	Apply the knowledge to solve environmental issues.
CO-7	Use the techniques and skills for doing analysis of soil and waste water.
CO-8	Undertake teaching, research and offer administrative and consultancy services.

SEMESTER IV

M.Sc II (Analytical Chemistry)

COURSE CODE - CHEM 667
COURSE NAME: CHEMISTRY PAPER I (QUALITY IN ANALYTICAL CHEMISTRY- II)

After successful completion of this course, students will be able to:	
CO-1	Ccomprehend the role of solvent extraction and membrane techniques in sample pre-treatment.
CO-2	Explain the terms; elaborate the methods of preparation and quality assessment with regards to herbal based products.
CO-3	Iillustrate the principles and applications of green chemistry from industry perspective.
CO-4	Explain and compare different methods of electrophoresis.
CO-5	Describe the preparation and analysis of nano-scale materials.

COURSE CODE: CHEM 668

COURSE NAME: CHEMISTRY PAPER II (ADVANCED INSTRUMENTAL TECHNIQUES - II)

After successful completion of this course, students will be able to:	
CO-1	Relate FT-NMR, COSY, TOCSY and HETCOR spectroscopy and its applications in various fields.
CO-2	Discover the importance of MRI and NMR to other nuclei
CO-3	Interpret the applications of SERS and resonance Raman spectroscopy
CO-4	Correlate the applications of isotopic dilution method, radio-release method, radiometric titration and radioimmunoassay.
CO-5	Apply the principle, interfacing, instrumentation, and applications of thermal methods
CO-6	Articulate the various hyphenated analytical instruments and its applications in different fields
CO-7	Understand and explain the concept of hyphenation, need for hyphenation, possible hyphenations.

COURSE CODE: CHEM 669

COURSE NAME: CHEMISTRY PAPER III (SELECTED TOPICS IN ANALYTICAL CHEMISTRY)

After successful completion of this course, students will be able to:	
CO-1	Apply the concepts of different types of effluent treatment.
CO-2	Explain the process of waste management in day-to-day life
CO-3	Classify the plastics and report the impact of plastics on environment
CO-4	Analyze and apply the appropriate methods of analysis for paints and pigments
CO-5	Apply the knowledge of metallurgy in analysis of mineral, alloys and environmental management.

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COURSE CODE: CHEM67012

COURSE NAME: CHEMISTRY PAPER IV (Pharmaceutical andOrganic Analysis)

After successful completion of this course, students will be able to:	
CO-1	Deal with different pharmaceutical formulations and dosage forms
CO-2	Realize the role of legislative body in pharmaceutical industry.
CO-3	Apply the knowledge of analytical processes in drug analysis.
CO-4	Appreciate the role of analytical chemistry in forensic science.
CO-5	Gain knowledge of the various aspects of cosmetic industry.

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COURSE CODE: CHEM671

COURSE NAME: CHEMISTRY PAPER V (Reaearch Project)

After successful completion of this course, students will be able to:	
CO-1	Acquire new knowledge and understanding in a particular field of research.
CO-2	Have the ability to design or perform the new method or techniques developed during research
CO-3	Interpret and present a report on the research performed.
CO-4	Enhance the ability to use technology.
CO-5	Have insights, ideas in identifying resource selection and collaborate interdepartmental / interfaculty research activities.