DEPARTMENT OF CHEMISTRY

National Education Policy-2020

PROGRAM OUTCOME OF UG CHEMISTRY SYLLABUS

Semester-wise Titles of the Papers in B.Sc. Chemistry

Year	Sem.	Course Code	Paper Title	Theory/Practical	Credits
Certificate in Bioorganic and Medicinal Chemistry					
1	I	B020101T	Fundamentals of Chemistry	Theory	4
		B020102P	Quantitative Analysis	Practical	2
	II	B020201T	Bioorganic and Medicinal Chemistry	Theory	4
		B020202P	Biochemical Analysis	Practical	2
Diploma in Chemical Dynamics and Analytical Techniques					
2	III	B020301T	Chemical Dynamics & Coordination Chemistry	Theory	4
		B020302P	Physical Analysis	Practical	2
	IV	B020401T	Quantum Mechanics and Analytical Techniques	Theory	4
		B020402P	Instrumental Analysis	Practical	2
Degree in Bachelor of Science					
3	V	B020501T	Organic Synthesis-A	Theory	4
		B020502T	Rearrangements and Chemistry of Group Elements	Theory	4
		B020503P	Qualitative Analysis	Practical	2
		B020504R	Research Project	Project	3
	VI	B020601T	Organic Synthesis-B	Theory	4
		B020602T	Chemical Energetics and Radiochemistry	Theory	4
		B020603P	Analytical Methods	Practical	2
		B020604R	Research Project	Project	3

Total no. of Programme in UG Chemistry: 01

Total no. of Courses in UG Chemistry: 16

Purpose of the Program

The purpose of the undergraduate chemistry program at the college level is to provide the key knowledge base and laboratory resources to prepare students for careers as professionals in various industries and Research institutions.

Program's Outcomes

1. Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in analytical, Inorganic, Organic and Physical Chemistries.
2. Students will be able to design and carry out scientific experiments as well as accurately record and analyse the results of such experiments.
3. Students will be skilled in problem-solving, critical thinking and analytical reasoning as applied to scientific problems.
4. Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
5. Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behaviour in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health and medicine.
6. Students will be able to explain why chemistry is an integral activity for addressing social, economic, and environmental problems.
7. Students will be able to function as members of an interdisciplinary problem-solving team.

	PROGRAM SPECIFIC OUTCOMES (PSOS)
First	**CERTIFICATE IN BIOORGANIC AND MEDICINAL CHEMISTRY**
	Certificate in Bioorganic and Medicinal Chemistry will give the student a basic knowledge of all the fundamental principles of chemistry like molecular polarity, bonding theories of molecules, Periodic properties of more than 111 elements, mechanism of organic Reactions, Stereochemistry, basic mathematical concepts and computer knowledge, chemistry of carbohydrates, proteins and nucleic acids: medicinal chemistry, synthetic polymers, synthetic dyes, Student will be able to do to qualitative quantitative and biochemical analysis of the compounds in the laboratory. This certificate course is going to prepare the students for various fields of chemistry and will give an insight into all the branches of chemistry and enable our students to join the knowledge and available opportunities related to chemistry in the government and private sector services, particularly in the field of food safety, health inspector, pharmacist etc. Have a broad foundation in chemistry that stresses scientific reasoning and analytical problem solving with a molecular perspective.
Second	**DIPLOMA IN CHEMICAL DYNAMICS AND ANALYTICAL TECHNIQUES**

	A diploma in Chemical Dynamics and Analytical Techniques will provide the theoretical as well as practical knowledge of handling chemicals, apparatus, equipment and instruments. The knowledge about the feasibility and velocity of chemical reactions through chemical kinetics, chemical equilibrium, phase equilibrium, kinetic theories of Gases, solid and liquid states, coordination chemistry, metal carbonyls and bioinorganic will enable the students to work as chemists in pharmaceutical industries. The knowledge about atomic structure, quantum mechanics, various spectroscopic tools and separation techniques will make the students skilled to work in industries: Achieve the skills required to succeed in the chemical industry like cement industries, Agro product, paint industries, rubber industries, petrochemical industries, food processing industries, Fertilizer industries, pollution monitoring and control agencies etc. Got exposure to a breadth of experimental techniques using modern instrumentation Learn the laboratory skills and safe measurements to transfer and interpret knowledge entirely in the working environment. monitoring of environmental issues: monitoring of environmental pollution problems of atmospheric sciences, water chemistry and soil chemistry and design processes that meet the specified needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental considerations
Third	**DEGREE IN BACHELOR OF SCIENCE**
	The degree in Bachelor of Science programme aims to introduce very important aspects of the modern-day course curriculum, namely, chemistry of hydrocarbons, alcohols, carbonyl compounds, carboxylic acids, phenols, amines, heterocyclic compounds, natural products main group elements, qualitative analysis, separation techniques and analytical techniques. It will enable the students to understand the importance of the elements in the periodic table including their physical and chemical nature and role in daily life and also to understand the concept of chemistry to interrelate and interact with other subjects like mathematics, physics, biological science etc. • Upon completion of a degree, chemistry students can employ critical thinking and scientific inquiry in the performance, design, interpretation and documentation of laboratory experiments, at a level suitable to succeed at an entry-level position in the chemical industry or a chemistry graduate program • Various research institutions and industry people in the pharmaceuticals, polymers, and food industry sectors will surely value this course.

Programme/Class: Certificate in Bioorganic and Medicinal Chemistry	
Year: First	**Semester-First**
Paper-1 (Theory)	
Course Code: B020101T	**Course Title: Fundamentals of Chemistry**

Course outcomes:

There is nothing more fundamental to chemistry than the chemical bond. Chemical bonding is the language of logic for chemists. Chemical bonding enables scientists to take the 100-plus elements of the periodic table and combine them in myriad ways to form chemical compounds and materials. Periodic trends, arising from the arrangement of the periodic table, provide chemists with an invaluable tool to quickly predict an element's properties. These trends exist because of the similar atomic structure of the elements within their respective group families or periods, and because of the periodic nature of the elements. Reaction mechanism gives the fundamental knowledge of carrying out an organic reaction in a step-by-step manner. This course will provide a broad foundation in chemistry that stresses scientific reasoning and analytical problem-solving with a molecular perspective. Students will gain an understanding of

- Molecular geometries, physical and chemical properties of the molecules.
- Current bonding models for simple inorganic and organic molecules to predict structures and important bonding parameters.
- The chapter Recapitulation of Basics of Organic Chemistry gives the most primary and utmost important knowledge and concepts of organic Chemistry.
- This course gives a broader theoretical picture of multiple stages in an overall chemical reaction. It describes reactive intermediates, transition states and states of all the bonds broken and formed. It enables us to understand the reactants, catalysts, stereochemistry and major and minor products of any organic reaction.
- It describes the types of reactions the Kinetic and thermodynamic aspects one should know for carrying out any reaction and the ways how the reaction mechanism can be determined.
- The chapter Stereochemistry gives a clear picture of the two-dimensional and three-dimensional structure of the molecules, and their role in reaction mechanism.

Programme/Class: Certificate in Bioorganic and Medicinal Chemistry	
Year: First	**Semester-First**
Paper-2 (Practical)	
Course Code: B020102P	**Course Title: Quantitative Analysis**

Course outcomes:

Upon completion of this course, the students will have the knowledge and skills to: understand the laboratory methods and tests related to the estimation of metal ions and the estimation of acids and alkali contents in commercial products.

- Potability tests of water samples.
- Estimation of metal ions in samples
- Estimation of alkali and acid contents in samples
- Estimation of inorganic salts and hydrated water in samples

Programme/Class: Certificate in Bioorganic and Medicinal Chemistry	
Year: First	**Semester-Second**
Paper-1 (Theory)	
Course Code: B020201T	**Course Title: Bioorganic and Medicinal Chemistry**

Course outcomes:

Biomolecules are important for the functioning of living organisms. These molecules perform or trigger important biochemical reactions in living organisms. When studying biomolecules, one can understand the physiological function that regulates the proper growth and development of the human body. This course aims to introduce the students to basic experimental understanding of carbohydrates, amino acids, proteins, nucleic acids and medicinal chemistry. Upon completion of this course, students may get job opportunities in the food, beverage and pharmaceutical industries.

Programme/Class: Certificate in Bioorganic and Medicinal Chemistry	
Year: First	**Semester-Second**
Paper-2 (Practical)	
Course Code: B020202P	**Course Title: Biochemical Analysis**

Course outcomes:

This course will provide basic qualitative and quantitative experimental knowledge of biomolecules such as carbohydrates, proteins, amino acids, nucleic acids drug molecules. Upon successful completion of this course, students may get job opportunities in the food, beverage and pharmaceutical industries.

Programme/Class: Diploma in Chemical Dynamics and Analytical Techniques	
Year: Two	**Semester-Third**
Paper-1 (Theory)	
Course Code: B020301T	**Course Title: Chemical Dynamics & Coordination Chemistry**

Course outcomes:

Upon successful completion of this course, students should be able to describe the characteristics of the three states of matter and describe the different physical properties of each state of matter. kinetic theory of gases, laws of crystallography, liquid state and liquid crystals, conductometric, potentiometric, optical methods, polarimetry and spectrophotometer techniques to study Chemical kinetics and chemical equilibrium. After the completion of the course, Students will be able to understand metal-ligand bonding in transition metal complexes and, the thermodynamic and kinetic aspects of metal complexes.

Programme/Class: Diploma in Chemical Dynamics and Analytical Techniques	
Year: Two	**Semester-Third**
Paper-2 (Practical)	
Course Code: B020302P	**Course Title: Physical Analysis**

Course Outcomes: Upon successful completion of this course students should be able to calibrate apparatus and prepare solutions of various concentrations, estimate components through volumetric analysis; to perform dilatometric experiments: one and two-component phase equilibrium experiments.

Programme/Class: Diploma in Chemical Dynamics and Analytical Techniques	
Year: Two	**Semester-Fourth**
Paper-1 (Theory)	
Course Code: B020401T	**Course Title: Quantum Mechanics and Analytical Techniques**

Course Outcomes:

Upon successful completion of this course, students should be able to describe the atomic structure, elementary quantum mechanics, wave function and its significance; Schrodinger wave equation and its applications; Molecular orbital theory, basic ideas – Criteria for forming molecular orbital from atomic orbitals, Molecular Spectroscopy, Rotational Spectrum, vibrational Electronic Spectrum: photochemistry and kinetics of photochemical reaction.

Analytical chemistry plays an enormous role in our society, such as in drug manufacturing, process control in industry, environmental monitoring, medical diagnostics, food production, and forensic surveys. It is also of great importance in different research areas. Analytical chemistry is a science that is directed towards creating new knowledge so that chemical analysis can be improved to respond to increasing or new demands.

- Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
- Students will be able to function as members of an interdisciplinary problem-solving team.
- Students will be skilled in problem-solving, critical thinking and analytical reasoning as applied to scientific problems.
- Students will gain an understanding of how to determine the structure of organic molecules using IR and NMR spectroscopic techniques.
- To develop basic skills required for purification, solvent extraction, TLC and column chromatography.

Programme/Class: Diploma in Chemical Dynamics and Analytical Techniques	
Year: Two	**Semester-Fourth**
Paper-2 (Practical)	
Course Code: B020402P	**Course Title: Instrumental Analysis**

Course outcomes:

Upon completion of this course, chemistry majors can employ critical thinking and scientific inquiry in the performance, design, interpretation and documentation of laboratory experiments, at a level suitable to succeed at an entry-level position in the chemical industry or a chemistry graduate program.

- Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
- Students will be able to function as members of an interdisciplinary problem-solving team.
- Students will be skilled in problem-solving, critical thinking and analytical reasoning as applied to scientific problems.
- Students will gain an understanding of how to determine the structure of organic molecules using IR and NMR spectroscopic techniques.

- To develop basic skills required for purification, solvent extraction, TLC and column chromatography.

Programme/Class: Degree in Bachelor of Science	
Year: THREE	**Semester-Fifth**
Paper-1 (Theory)	
Course Code: B020501T	**Course Title: Organic Synthesis A**

Course outcomes:

Hydrocarbons are the principal constituents of petroleum and natural gas. They serve as fuels and lubricants as well as raw materials for the production of plastics, fibres, rubbers, solvents and industrial chemicals. This course will provide a broad foundation for the synthesis of hydrocarbons. Hydroxy and carbonyl compounds are industrially important compounds. The plastics, fibres, petroleum, and rubber industries will especially recognize this course. Students will understand which are used as solvents and raw materials to synthesize drugs and other pharmaceutically essential compounds.

- Synthesis and chemical properties of aliphatic and aromatic hydrocarbons.
- Synthesis and chemical properties of alcohols, halides, carbonyl compounds, carboxylic acids, and esters.
- How to design and synthesize aliphatic and aromatic hydrocarbons.
- How to convert aliphatic and aromatic hydrocarbons to other industrially essential compounds.
- Functional group interconversion.

Programme/Class: Degree in Bachelor of Science	
Year: THREE	**Semester-Fifth**
Paper-2 (Theory) Elective	
Course Code: B020502T	**Course Title: Rearrangements and Chemistry of Group Elements**

Course outcomes:

This paper provides detailed knowledge of the synthesis of various classes of organic compounds and Functional groups interconversion. Organic synthesis is the most important branch of organic chemistry, which provides jobs in production and QC departments related to chemicals, drugs, medicines, FMCG, etc. industries.

- It relates and gives an analytical aptitude for synthesizing various industrially essential compounds.
- This paper also provides a detailed knowledge of the elements present in our surroundings and their occurrence in nature. Their position in the periodic table, their physical and chemical properties, and their extraction. This paper also gives a detailed understanding of the s, p, d, and f block elements and their characteristics

Program/Class: Degree in Bachelor of Science	
Year: THREE	**Semester-Fifth**
Paper-3 (Practical)	
Course Code: B020503P	**Course Title: Qualitative Analysis**

Course outcomes:

Upon completing this course, the students will have the knowledge and skills to understand the laboratory methods and tests related to inorganic mixtures and organic compounds.

- Identification of acidic and basic radicals in inorganic mixtures.
- Separation of organic compounds from mixture.
- Elemental analysis in organic compounds.
- Identification of functional groups in organic compounds.
- Identification of organic compound.

Program/Class: Degree in Bachelor of Science	
Year: THREE	**Semester-Sixth**
Paper-1 (Theory) Compulsory	
Course Code: B020601T	**Course Title: Organic Synthesis B**

Course outcomes:

This paper provides detailed knowledge of synthesizing various classes of organic compounds and functional groups inter-conversion. Organic synthesis is the most important branch of organic chemistry, which offers jobs in production and QC departments related to chemicals, drugs, medicines, FMCG, etc.

The study of natural products and heterocyclic compounds offers an excellent strategy for identifying novel biological probes for several diseases. Historically, natural products have played an essential role in the development of pharmaceutical drugs for several diseases, including cancer and infection.

- It relates and gives an analytical aptitude for synthesizing various industrially essential compounds.
- Learn the different types of alkaloids, terpenes, etc, and their chemistry and medicinal importance.
- Explain the importance of natural compounds as lead molecules for new drug discovery.

Program/Class: Degree in Bachelor of Science	
Year: THREE	**Semester-Sixth**
Paper-2 (Theory) Elective	
Course Code: B020602T	**Course Title: Chemical Energetics and Radio Chemistry**

Course outcomes:

Upon completing this course, students should be able to describe laws of thermodynamics and their applications, phase equilibria of one and two-component systems, electrochemistry, ionic equilibrium applications of conductivity, and potentiometric measurements.

Program/Class: Degree in Bachelor of Science	
Year: THREE	**Semester-Sixth**
Paper-3 (Practical)	
Course Code: B020603P	**Course Title: Analytical Methods**

Course Outcomes:

Upon completing this course, students should be able to quantify the product obtained through the gravimetric method, determine Rf values, identify organic compounds through paper and thin-layer chromatography laboratory techniques, and perform thermochemical reactions.

PROGRAM OUTCOME OF PG CHEMISTRY SYLLABUS

M.Sc. (Chemistry)

Department of Chemistry, Dayanand Vedic College, Orai, Jalaun, is an updated M.Sc. Chemistry syllabus as per NEP-2020. It aims to develop young talents for scientific research, the chemical industry, and education. The curriculum is designed so students can venture into allied fields. Through the courses offered by the department, the department aims to provide "a cut above the rest" workforce for the growing demands of the industry and prepare the students for higher studies and research. The interactive teaching method in the Department of Chemistry is meant to bring about behavioural change for future industry professionals. Equal importance is given to practical and theoretical learning methods apart from experiential and digital methods. Industrial projects form an integral part of the curriculum. Apart from the curriculum, the university emphasizes value addition programs like Current Affairs, Holistic Education, Certificate Courses, and Placement Training Programs, which include training the students in group discussions, face-to-face interviews, etc. We have a diverse student population representing almost all states in India and abroad. The department is blessed with highly qualified faculty members from diverse backgrounds involved in cutting-edge research in various subject areas and interdisciplinary areas. The curriculum is frequently revised and provides opportunities for projects and joint research with faculty members.

Apart from curricular subjects, the department offers personality development and society-oriented programs, career guidance, placements, and opportunities to participate in competitions, seminars, and conferences. Our commitment to excellence in teaching and research has helped graduate students from the department achieve distinction in academia and industry.

Program Outcomes (POs)

PO1: Creative Thinking: Students will be able to think creatively (divergent and convergent), propose new ideas to explain facts and figures, or provide unique solutions to problems in chemistry. Drawing skills and logical conclusions from observations and scientific experiments will also develop.

PO2: Interdisciplinary Approach: Students will feel how development takes place in any science. The subject helps in the development of other science subjects and vice versa and how the Interdisciplinary approach helps to provide better solutions and new ideas for sustainable Events. as well as knowledge of subjects in other faculties such as humanities, performance arts, social science, etc. can have immense and compelling influence which motivates to develop New scientific theories and inventions.

PO3: Personality Development: Students will imbibe moral, ethical, and social values. Personal and social life leads to a highly cultured and civilized personality. They will also Realize that the pursuit of knowledge is a lifelong activity and that, combined with tireless efforts, a positive attitude, and other essential qualities, leads to a successful life.

PO4: Skills in Research and Industry: Scientific temper will be inculcated in students, and they will be able to learn the skills needed to be successful in the research or industrial sector. Besides, they will acquire skills in handling, planning, and performing scientific equipment in laboratory Experiments.

PO5: Communication Skills: Students will develop various communication skills such as reading, listening, speaking, etc., which will help them express thoughts and ideas clearly and effectively.

PO6: Environmental Monitoring: Students will be able to understand environmental issues and will create awareness of global warming, climate change, acid rain, ozone depletion, and community.

Program Specific Outcomes (PSOs)

PSO-1 Students will understand the basic concepts, fundamental principles, and scientific theories related to various scientific phenomena and their relevancies in day-to-day life. They will also be able to acquire knowledge about the fundamentals and applications of chemical and scientific theories.

PSO-2 Students will find that every branch of science and technology is related to Chemistry. They will develop a scientific outlook not only concerning science subjects but also in all aspects related to life.

PSO-3 Students will become familiar with the different branches of chemistry, such as analytical, organic, inorganic, physical, environmental, polymer, and biochemistry. They will also learn to apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and industries.

PSO-4 The student will acquire knowledge of Chemical Thermodynamics, Kinetics, Electrochemistry, Atomic Structure, Organic Chemistry, Spectroscopy, and Skills in Industrial Chemistry.

PSO-5 Viewing chemistry as a tool, the developing mind and critical attitude, and the faculty of logical reasoning prepared to serve in diverse fields.

PSO-6 Students will gain a thorough Knowledge of the subject to be able to work on projects at different research as well as academic institutions.

Course Structure For M.Sc. Chemistry (VII-X Semester)

SEMESTER	PAPER CODE	PAPER	THEORY (MARKS-75 MAX.)	INTENRAL (MARKS - 25)			CREDIT
			75	25*			
			75	10	10	5	
VII	CHY 701	Application of Computer in Chemistry	75				4
	CHY 702	Inorganic Chemistry	75				4
	CHY 703	Organic Chemistry	75				4
	CHY 704	Physical Chemistry	75				4
	CHY 705	Minor Elective Course	75				4
	CHY 706	Practical (Organic, Inorganic, & Physical Chemistry)	75				4
	CHY 707	Research Project/Industrial & field Training/ Survey	100	-	-	-	4
VIII	CHY 801	Inorganic and Group Theory	75				4
	CHY 802	Organic Chemistry	75				4
	CHY 803	Physical Chemistry	75				4
	CHY 804	Spectroscopy	75				4
	CHY 805	Practical (Inorganic, Organic, & Physical Chemistry)	75				4
	CHY 806	Research Project/Dissertation (continue 707)	100	-	-	-	4
IX	CHY 901	Application of spectroscopy	75				4
	CHY 902	Biochemistry	75				4
	CHY 9031-9034	Paper Elective	75				4
	CHY 9041-9044	Paper Elective	75				4
	CHY 905	Practical (Organic, Inorganic, & Physical Chemistry)	75				4
	CHY 906	Research Project/ Industrial & field Training/ Survey	100	-	-	-	4
X	CHY 1001	Photochemistry/ Solid State	75				4
	CHY 1002	Environmental chemistry	75				4
	CHY 10031-10034	Paper Elective	75				4
	CHY 10041-10044	Paper Elective	75				4
	CHY 1005	Practical (Instrumental methods of Analysis and Organic Synthesis)	75				4
	CHY 1006	Project/Dissertation	100	-	-	-	4
		Grand Total	**2500**				**100**

Note: Duration of practical examination shall be 16 Hrs. (8 Hrs. / day) in each semester *Internal assessment 25% weightage of a course which includes 10 Marks mid-term assessment, 10 marks assignment/ presentation of given project and 5 marks of attendance/ activities.

Total no. of Programme in PG Chemistry: 01

Total no. of Courses in PG Chemistry: 25

M.Sc. SEMESTER – VII

Paper -1

CHY-701: Application of Computer in Chemistry

Paper Type: Theory **Total Hours: 60**

Paper type: Core **Total Credits: 4**

Objective:

The objective of the course is to help the students learn the basics of computers to deal with text formatting, statistical analysis, presentations and writing programs to solve various chemical equations.,

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Learn the fundamentals of computer systems and its components.

CO2: Work on a word processor and create well-formatted documents. create spreadsheets, employ basic functions, create charts, and perform statistical analysis.

CO3: learn programming in chemistry and write programs for solving chemical equations.

CO4: Learn Monte Carlo and molecular dynamics programs with data preferably from a physical chemistry laboratory; further, the students will operate this program in chemistry.

CO5: Development of small computer codes involving simple formulae in chemistry, such as Vander Waals's equation, pH titration, kinetics etc.

Paper -2

CHY-702: Inorganic Chemistry

Paper Type: Theory **Total Hours: 60**

Paper type: Core **Total Credits: 4**

Objective:

Understanding structure, bonding and reaction mechanism involved in inorganic solids, metal-ligand bonding and metal pi-complexes. Applying practical aspects of inorganic chemistry in research and development.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Stereochemistry and Bonding: Compare trends in the properties of main group elements and discuss mechanisms of inorganic reactions.

CO2: Examine and apply the stability of metal complexes concerning the nature of metal ions and ligands.

CO3: Discuss the concepts of organometallic and nuclear chemistry 6. Justify the implication of nuclear chemistry in energy generation.

CO4: The students can pursue their careers in higher education, scientific research and teaching.

Paper -3

CHY-703: Organic Chemistry

Paper Type: Theory **Total Hours: 60**

Paper type: Core **Total Credits: 4**

Objective:

Upon completing this course, students can apply the concepts of bonding, aromaticity, stereochemistry, reaction mechanism and different types of stereochemical reactions.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Nature of bonding in organic molecules, concept of aromaticity, antiaromaticity and homo aromaticity with different examples.
CO2: Stereochemistry- All concepts, including stereospecific and stereoselective synthesis, asymmetric synthesis, optical activity in the absence of chiral carbon, and stereochemistry of compounds containing nitrogen, sulfur, and phosphorus.
CO3: Reaction mechanism: Structure and reactivity, Physical organic chemistry which will help students to understand the basics of organic chemistry and new approaches in Organic Chemistry
CO4: This course aims to explain the different types of pericyclic reactions, the stereochemistry of the same, and simple rules to predict the feasibility of the reaction and the stereochemical outcome.

Paper -4

CHY-704: Physical Chemistry

Paper Type: Theory **Total Hours: 60**
Paper type: Core **Total Credits: 4**
Objective:
Physical chemistry is focused on understanding the macro and microscopic properties. Their discoveries are based on understanding chemical thermodynamics, statistical thermodynamics and quantum chemistry describing their behaviour using theories of physics and mathematical computations
Course Outcomes:
After successful completion of this course, students will be able to:
CO1: This course deals with basic rules and mathematical concepts of physical chemistry.
CO2: This chapter deals with different types of quantum particles like bosons and fermions. This is very fundamental in nature and can be studied in particle physics.
CO3: Understand the laws of thermodynamics and their applications to determine the molar conductivity of a strong electrolyte at different concentrations and verify the Debye Hückel-Onsager equation.
CO4: Students learn about classical thermodynamics, statistical thermodynamics, phase equilibria, and thermodynamics of biological systems.
CO5: know the phase diagram of three component systems and second order phase diagram.
CO6: Understand the quantum chemistry of free electrons and H- atoms. To understand and appreciate the quantum mechanical approach to the atomic and molecular electronic structure.
CO7: Understand the operator and application of the Schrödinger wave equation.

Paper -5

CHY-705: Climate Change and environmental degradation

Paper Type: Theory **Total Hours: 60**
Paper type: Minor **Total Credits: 4**
Objective:
To study climate change and degradation.
Course Outcomes:
After successful completion of this course, students will be able to:
CO1: know the effects of climate change on the natural environment.

CO2: understand how climate change can lead to habitat destruction and how habitat destruction can interact with other aspects of climate change to threaten the survival of some animal species.
CO3: understand how climate change has the potential to increase air pollution with potentially life-threatening consequences.
CO4: understand how climate change can worsen soil erosion and result in further climate change
CO5: Identify how systems work by looking at the relationships between climate and other forms of environmental change.

Practical

CHY-706: Practical (Organic, Inorganic, & Physical Chemistry)

Paper Type: Practical **Total Hours: 270**
Paper type: Core **Total Credits: 4**

Objective:

The objective of laboratories is an important and ever-evolving topic of discussion amongst students and laboratory staff. It is often assumed that both teaching staff and students are implicitly aware of instruments and reagents. Applying practical aspects of inorganic chemistry in research and development

Course Outcomes:

After successful completion of this course, students will be able to:
CO1: Discuss laboratory safety, material safety data sheet and prevention of accident & first aid measurement.
CO2: Chromatographic separation of metal ions.
CO3: Determine the distribution coefficient of iodine in different solvents.
CO4: Analyse primary binary mixtures of organic compounds.
CO5: Separation of cations and anions by paper and column chromatography.

M.Sc. SEMESTER – VIII

Paper -1

CHY-801: Inorganic Chemistry

Paper Type: Theory **Total Hours: 60**
Paper type: Core **Total Credits: 4**

Objective:

The objective of this core paper is to explain the electronic spectra and magnetic properties of transition metal complexes and also focus on charge transfer spectra and the spectroscopic method of assignment of absolute configuration.

Course Outcomes:

After successful completion of this course, students will be able to:
CO1: Study kinetics and mechanism of substitution reactions in Co (III) Octahedral, Tetrahedral and square planar Pt (II) complexes. Electron Transfer Reactions of metal complexes
CO2: Study Orgel and Tanabe-Sugano Diagram (d1-d9) complexes.
CO3: Study HNCC and LNCC carbonyl, Boranes, Carboranes and metal halide cluster.
CO4: Study Elements of Symmetry and Point Groups, understand multiplication tables, irreducible representations, and orthogonality Theorem, Understand Matrix Representations of Symmetry Elements, Transformation Matrices, Cartesian coordinate and internal coordinate methods of normal mode analysis for different point groups.

Paper -2

CHY-802: Organic Chemistry

Paper Type: Theory **Total Hours: 60**

Paper type: Core **Total Credits: 4**

Objective:

On completion of this course, students will be able to apply the concepts of bonding, aromaticity, stereochemistry, reaction mechanism and different types of stereochemical reactions.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Explain methods of preparation and applications of organometallic reagents like organolithium, organic copper, organosilicon, and organoborane reagents in organic synthesis.

CO2: Discuss the reagents used in reactions like Carbonyl methylenation, carbene insertion, and C-H activation.

CO3: Discuss the reagents used in reactions like Carbonyl methylenation, carbene insertion, and C-H activation.

CO4: Discuss Ring formation reactions, ring opening and closing, metathesis, and 1,3 dipolar cycloaddition reactions.

CO5: Discuss new synthetic reactions involving C-C coupling reaction, C=C formation reaction, multi-component reactions.

CO6: Explain the order of events, one bond and two bonds C-C and C-X disconnection and control in carbonyl condensation with examples.

Paper -3

CHY-803: Physical Chemistry

Paper Type: Theory **Total Hours: 60**

Paper type: Core **Total Credits: 4**

Objective:

This course aims to acquaint the students with the knowledge of various concepts and principles related to physical chemistry and electrochemistry. Designed as per current syllabus NEP-2022 Guidelines and recent research trends.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Students will understand the fundamentals of Chemical dynamics, Oscillatory reactions, and methods of fast reactions.

CO2: Students will be able to understand surface chemistry, like adsorption and colloidal chemistry, and chemical reactions.

CO3: To understand the concept of macromolecules and the determination of the molecular weight of the polymer and their application.

CO4: Students come to know about applied electrochemistry and electrochemical catalysis reactions. Butler Volmer's equation, Tafel's plot, and Ilkovic's equation are necessary for the electrochemical concept.

CO5: This course will equip the students with the necessary detailed chemical knowledge concerning the chemistry of macromolecules.

CO6: Students will be skilled in problem-solving, critical thinking, and analytical reasoning as applied to scientific problems.

Paper -4

CHY-804: Spectroscopy

Paper Type: Theory **Total Hours: 60**

Paper type: Core **Total Credits: 4**

Objective:

The objective of this course is to acquaint the students with the knowledge of various concepts of spectroscopy. Designed as per current syllabus NEP-2022 Guidelines and recent research trends.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Classification of Microwave Spectroscopy and their implication on electron spin interaction.

CO2: Describe the principles of spectroscopic methods such as NMR, IR and UV-Vis.

CO3: Demonstrate a good understanding of the electromagnetic spectrum and how this can be applied to studying chemical molecules.

CO4: Instrumentation and Application of Nuclear Magnetic Resonance Spectroscopy.

CO5: This course will equip the students with the necessary detailed X-ray diffraction: Bragg condition, miller indices, Laue method, Bragg method

CO6: Students will be skilled in problem-solving, critical thinking and analytical reasoning as applied to scientific problems.

Practical

CHY - 805: Practical (Inorganic, Organic, & Physical Chemistry)

Paper Type: Practical **Total Hours: 270**

Paper type: Core **Total Credits: 4**

Objective:

Impart training in operating different instruments used to analyse various chemical constituents.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Separation and determination of two metal ions Cu-Ni, Ni-Zn, Cu-Fe, etc. involving volumetric and gravimetric methods

CO2: Determination of phase equilibria and their determination of congruent composition and temperature of a binary system.

CO3: Determine the distribution coefficient of iodine in different solvents.

CO4: Preparation of different name reactions.

M.Sc. SEMESTER – IX

Paper -1

CHY-901: Application of Spectroscopy

Paper Type: Theory Total Hours: 60

Paper type: Core Total Credits: 4

Objective:

The objective of the core paper electronic spectra and magnetic properties of transition metal complexes focus on charge transfer spectra and spectroscopic method of assignment of absolute configuration.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Symmetry and shape AB2, AB3, AB4, AB5 and AB6 mode of vibration spectra.

CO2: Study Electron Spin Resonance Spectroscopy

CO3: Study Mossbauer Spectroscopy

CO4: Study important concepts of UV-visible spectroscopy and its role in the structure elucidation of organic compounds

CO5: Study important concepts of Infrared Spectroscopy and its role in the structure elucidation of organic compounds

CO6: Study important concepts of 1H NMR and 13C NMR spectroscopy and its role in structure elucidation of organic compounds

CO7: Study important concepts of Mass spectrometry and its role in structure elucidation of organic compounds.

Paper -2

CHY - 902: BIOCHEMISTRY

Paper Type: Theory **Total Hours: 60**

Paper type: Core **Total Credits: 4**

Objective:

This course aims to acquaint the students with the knowledge of various concepts and principles related to physical chemistry and electrochemistry. Designed as per the current syllabus NEP-2022 Guidelines and recent research trends.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Heme protein and oxygen uptake, structure and function of haemoglobin, myoglobin, and hemerythrin, model synthetic complexes of iron, copper, and cobalt. Na+ /K+ pump is Na+ /K+ ATPase and is found to maintain both the magnitude and direction of transmembrane concentration gradients of these ions. Haemoglobin, myoglobin, and haemerythrin play an important part in the transportation of oxygen.

CO2: Metal compounds are closely related to the life process. Among these compounds are chlorophyll, numerous haematin enzymes, metal-activated enzymes, vitamin B12, and those vital but poorly understood complexes that play an important role in the metabolism of metal ions.

CO3: Bioenergetics or biochemical thermodynamics is the study of energy G, which is the useful energy that also Changes in biochemical reactions. Free energy is known as the chemical potential. In living cells, the principal high-energy intermediate or carrier compound is ATP.

Paper -3

CHY 9031: Analytical techniques

Paper Type: Theory **Total Hours: 60**

Paper Type: Elective Paper-I **Total Credits: 4**

Objective:

The primary objective of this course is to acquire basic concepts, principles, instrumentations, and techniques of modern analytical techniques that would empower students with an analytical mindset and the ability to solve diverse analytical problems efficiently and quantitatively, conveying the importance of accuracy and precision of the analytical results.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Students will be able to define what makes a measurement accurate or inaccurate.

CO2: Upon completion of this lab, the student will be able to: Determine the molar concentration of an acid or base solution using data obtained from titration.

CO3: Upon completion of this lab, you will have an overview of industrial methods for ion exchange and liquid-liquid extraction and examples from radio chemical separation processes.

CO4: After this lesson, students will be able to define chromatography, demonstrate an understanding of the chromatography process, and describe the steps involved in a chromatography investigation.

CO5: Understanding various experimental measurement techniques involved in thermal analysis and understanding the concept of measured data analysis and data acquisition technique.

Paper -3

CHY 9032: Liquid state

Paper Type: Theory **Total Hours: 60**

Paper Type: Elective Paper-I **Total Credits: 4**

Objective:

The primary objective of this course is to acquire basic concepts, principles, Liquid's state

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Study of general properties of Liquids.

CO2: Theory of liquids.

CO3: Distribution function and related equations.

CO4: Methods for structure determination and computational techniques.

CO5: Supercooled and Ionic liquids.

Paper -3

CHY-9033: Bioinorganic Supramolecular Chemistry

Paper Type: Theory **Total Hours: 60**

Paper Type: Elective Paper-I **Total Credits: 4**

Objective:

The objective of this course is to acquire basic concepts and principles of Bioinorganic and supramolecular chemistry.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Study Metalloenzymes.

CO2: Understand the chemistry of Photosynthesis.

CO3: Understand the transport and storage of dioxygen through different carriers.

CO4: Study Electron Transfer in Biology involving metalloproteins and cytochromes.

CO5: Biological nitrogen fixation.

CO6: Role of Metals in Medicine.

CO7: Understand the underlying concepts of Supramolecular Chemistry, such as host-guest interactions, molecular recognition host design, templates, and self-assembly.

CO8: Study of Crown ethers Cryptands, Spherands, Podants, expanded porphyrins, guanidinium based receptors, solid-state clathrates, and zeolites.

Paper -3

CHY – 9034 Organic Synthesis

Paper Type: Theory **Total Hours: 60**

Paper Type: Elective Paper-I **Total Credits: 4**

Objective:

Organic synthesis involves strategies for making compounds from readily available starting materials in one or more steps. The heart of organic synthesis is designing synthetic routes to a molecule. Selectivity is important when determining a synthetic route to a target molecule. Chemists need to consider both stereoselectivity and chemo selectivity in organic synthesis. Synthetic reactions can be

categorized based on whether they involve functional group interconversion or carbon-carbon bond formation.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Explain methods of preparation and applications of organometallic reagents like organolithium, organic copper, organosilicon, and organoborane reagents in organic synthesis.

CO2: Discuss the reagents used in reactions like Carbonyl methylenation, carbene insertion and C-H activation.

CO3: Discuss different types of reagents used for oxidation and reduction reactions.

CO4: Make use of various rearrangement reactions for the synthesis of various compounds.

Paper -4

CHY-9041: Analytical Chemistry

Paper Type: Theory **Total Hours: 60**

Paper type: Elective paper-II **Total Credits: 4**

Objective:

The primary objective of this course is to acquire basic concepts, principles, and techniques of modern analytical chemistry that would empower students with an analytical mindset and the ability to solve diverse analytical problems efficiently and quantitatively that conveys the importance of accuracy and precision of the analytical results.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: To understand the range and uses of analytical methods in chemistry.

CO2: To establish an appreciation of the role of chemistry in quantitative analysis.

CO3: To develop an understanding of the broad role of the chemist in measurement and problem-solving for analytical tasks.

CO4: To provide an understanding of chemical methods employed for elemental and compound analysis.

CO5: To provide experience in some scientific methods employed in analytical chemistry to develop some understanding of the professional and safety responsibilities of working on chemical analysis.

CO6: Students will be able to design and carry out scientific experiments and accurately record and analyse the results of such experiments.

CO7: Students will be proficient in problem-solving, critical thinking, and analytical reasoning as applied to scientific problems.

Paper -4

CHY-9042: Organo transition Metal Chemistry

Paper Type: Theory **Total Hours: 60**

Paper type: Elective paper-II **Total Credits: 4**

Objective:

The objective of the core paper electronic spectra and magnetic properties of transition metal complexes focus on charge transfer spectra and spectroscopic method of assignment of absolute configuration.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Understand alkyls and aryls of transition Metals

CO2: Study compounds of Transition Metal with Carbenes and Carbynes.

CO3: Study Transition Metal π Complexes

CO4: Understand Catalysis involving organometallic compounds

CO5: Study Fluxional Organometallic Compounds.

Paper -4

CHY–9043 Natural Products

Paper Type: Theory **Total Hours: 60**

Paper type: Elective paper-II **Total Credits: 4**

Objective:

The course provides an overview of the field of natural product chemistry. It emphasizes classification, nomenclature, structure, biosynthesis, occurrence, analysis and pharmaceutical perspectives.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: provides an overview of the field of natural product chemistry. Gain knowledge about various terpenoids, their stereochemistry, biosynthesis, structural determination, synthesis and medicinal importance.

CO2: Explains structure, occurrence, biosynthesis, stereochemistry, classification and importance of various alkaloids

CO3: Studies the different types of steroids, their occurrence, structure, biosynthesis, properties, and important steroid hormones.

CO4: Determines biosynthetic mechanisms and discusses feeding experiments of biosynthetic precursors and secondary metabolites. Explain the acetate-malonate, shikimic, and malonic acid pathways of secondary metabolites with examples.

CO5: Discuss the occurrence, nomenclature, classification, biogenesis, and physiological effects of using natural products as starting materials for drugs.

CO6: To conduct independent testing of plant materials and natural products.

Paper -4

CHY – 9044: Advanced Quantum Chemistry

Paper Type: Theory **Total Hours: 60**

Paper type: Elective paper-II **Total Credits: 4**

Objective:

Physical chemistry is focused on understanding the macro and microscopic properties. Their discoveries are based on understanding chemical thermodynamics, statistical thermodynamics and quantum chemistry describing their behaviour using theories of physics and mathematical computations

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Theoretical and Computational treatment of atoms and molecules, Hartree-Fock Theory.

CO2: Configuration Interaction and MC-SCF.

CO3: Study of Semi-empirical theories.

CO4: Study of Density functional theory.

CO5: Study of Computer experiments.

Practical

CHY- 905: Practical (Organic, Inorganic & Physical Chemistry)

Paper Type: Practical **Total Hours: 270Hrs**

Paper type: core **Total Credits: 4**

Objective:

Impart training in operating different instruments used to analyse various chemical constituents.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Design chromatographic and titrimetric methods for identification of species.

CO2: Analyse different constituents through instrumental methods of analysis.
CO3: Preparation of inorganic compounds and their studies by I.R., Electronic spectra, and Mossbauer spectroscopy
CO4: To study the surface tension-concentration relationship for solutions (Gibb's equation).
CO5: Isolation of caffeine from tea leaves

M.Sc. SEMESTER – X

Paper -1

CHY-1001: Photochemistry/ Solid State

Paper Type: Theory **Total Hours: 60**
Paper type: Core **Total Credits: 4**

Objective:

The core paper aims to study the photochemical reaction and their stereochemistry. Along with this, students will get knowledge about crystal structure, stoichiometry, and solid-state reactions.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Photochemistry:

(A) Photochemical Reactions.
(B) Determination of reaction mechanism.
(C) Photochemistry of Alkenes.
(D)Photochemistry of Carbonyl Compounds.
(E) Photochemistry of aromatic compounds.
(F) Miscellaneous photochemical reactions.

CO2: Solid State:

(A) Solid State reactions.
(B) Crystal defects and non-stoichiometry.
(C) Electronic properties and band theory.

Paper -2

CHY1002 Environmental Chemistry

Paper Type: Theory **Total Hours: 60**
Paper type: Core **Total Credits: 4**

Objective:

This paper aims to study the impact of industry and infrastructure on the environment. Environmental chemistry offers the skills and expertise to enter fields like energy and consultancy, public health, environmental risk assessment, and pollution control.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Study of Environment.
CO2: Study of Hydrosphere.
CO3: Study of Soils.
CO4: Study of Atmosphere.
CO5: Study of Industrial Pollution.
CO6: Study of Environmental Toxicology.

Paper -3

CHY-10031: Medicinal Chemistry

Paper Type: Theory **Total Hours: 60**

Paper Type: Elective Paper-I **Total Credits: 4**

Objective:

Medicinal chemistry gives chemistry students a thorough understanding of drug mechanisms of action, structure-activity relationships (SAR), acid-base and physicochemical properties, and absorption, distribution, metabolism, excretion, and toxicity (ADMET) profiles.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Drug design

CO2: Pharmacokinetics

CO3: Pharmacodynamics

CO4: Antineoplastic agents

CO5: Cardiovascular drugs

CO6: Local anti-infective drugs

CO7: Psychoactive drugs-the chemotherapy of mind

Paper -3

CHY-10032: Chemistry of Materials

Paper Type: Theory **Total Hours: 60**

Paper Type: Elective Paper-I **Total Credits: 4**

Objective:

Material chemistry deals with the multiphase material and their applications. The most important application focuses on polymer composite with nanomaterials.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Development of multiphase material and properties of ferrous and non-ferrous alloys and their applications.

CO2: Characteristic of composite with nanomaterials.

CO3: Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases of liquid crystals.

CO4: Molecular shape, structure and configuration, crystallinity, stress-strain behaviour, thermal behaviour, polymer types, their applications, conducting, and ferroelectric polymers.

CO5: Conducting organics, organic superconductors, and magnetism in organic materials. Fullerenes-doped, fullerenes as superconductors.

Paper-3

CHN-10033: Organic Synthesis II

Paper Type: Theory **Total Hours: 60**

Paper Type: Elective Paper-I **Total Credits: 4**

Objective:

Organic synthesis involves strategies for making compounds from readily available starting materials in one or more steps. The heart of organic synthesis is designing synthetic routes to a molecule. Selectivity is important when determining a synthetic route to a target molecule. Chemists need to consider both stereoselectivity and chemo selectivity in organic synthesis. Synthetic reactions can be categorized based on whether they involve functional group interconversion or carbon-carbon bond formation.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Discuss the terminology, criteria for selecting a target, synthesis involving chemo and regioselectivity, reversal of polarity, and cyclization involved in retrosynthesis analysis.
CO2: Explain the order of events, one bond and two bonds C-C and C-X disconnection and control in carbonyl condensation with examples.
CO3: Discuss the types of asymmetric synthesis controlled by a chiral auxiliary, chiral catalyst, chiral substrate, and chiral reagent with examples.
CO4: Define strategic bond and discuss guidelines for disconnection with the greatest simplification using symmetry and corresponding to known reliable reactions, Retrosynthesis of retronecene, and longifolene.

Paper-3
CHY-10034 Physical Organic Chemistry

Paper Type: Theory **Total Hours: 60**
Paper Type: Elective Paper-I **Total Credits: 4**
Objectives:
The course deals with fundamental principles and methods used in physical and mechanistically organic chemistry
Course Outcomes:
After successful completion of this course, students will be able to:
CO1: Apply qualitative electronic structure theory to predict organic molecules' geometric structure, reactivity, and other properties (including organometallic compounds and conjugated polymers) and apply qualitative theoretical models to describe pericyclic reactions.
CO2: Predict the conformational preference of organic molecules and the stereochemical preference in reactions.
CO3: critically evaluate and apply different techniques to determine mechanisms of organic reactions.

CO4: describe different types of reactive intermediates and describe their importance in different reactions
CO5: apply fundamental concepts of chemical and biochemical catalysis.
CO6: Describe various forms of non-covalent interactions in organic, bioorganic, and supramolecular systems, and predict the influence of solvents on reactivity.
CO7: describe important processes of organic molecules in electronically excited.

Paper-4
CHY-1004: Elective Papers II
CHY-10041: Polymer Chemistry

Paper Type: Theory **Total Hours: 60**
Paper Type: Elective Paper-II **Total Credits: 4**
Objective:
The objective of the course is to complete knowledge of the kinetics, thermodynamics of polymerization, various techniques of determination of molecular mass, and applications of polymers in various fields of life will be provided to the students. Various factors affecting the structure and properties of polymers will be discussed in detail, making students aware of the things to be considered while preparing polymers commercially.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: The basic concepts of monomers, degree of polymerization, and classification of polymers are the backbone of polymer chemistry.

CO2: This will also help to develop skills to interpret and explain various factors affecting the structure and property of macromolecules.

CO3: To understand the concept of macromolecules and the determination of the molecular weight of the polymer and their application.

CO4: The students can pursue their career objectives in higher education, scientific research and teaching.

Paper-4

CHY - 10042: Computation Chemistry

Paper Type: Theory **Total Hours: 60**

Paper Type: Elective Paper -II **Total Credits: 4**

Objective:

Computational chemistry is a branch of chemistry that uses computer simulation to solve chemical problems. It uses methods of theoretical chemistry incorporated into computer programs to calculate the structures and properties of molecules, groups of molecules, and solids. It is essential because, apart from relatively recent results concerning the hydrogen molecular ion (dehydrogenate, see references therein for more details), the quantum many-body problem cannot be solved analytically, much less in closed form. While computational results normally complement the information obtained by chemical experiments, they can sometimes predict hitherto unobserved chemical phenomena. It is widely used in the design of new drugs and materials.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: This course will use Fortran 90 exclusively. We will cover the basics of Fortran 90 throughout this semester. You may want to get a good reference of Fortran 90 in hand.

CO2: Develop mathematical thinking and problem-solving skills associated with research and writing proofs. Get exposure to various mathematical concepts like probability used in computer science disciplines. Use Graph Theory for solving problems Acquire basic knowledge of sampling and estimation. Understand basic concepts of hypothesis

CO3: This lesson provides a broad overview of Computer Networking and the Internet. The lesson begins with an overview of the Internet and networking protocols, introducing key terms and concepts. Finally, we provide a brief overview of ATM, a networking technology that provides an important contrast with Internet technologies.

CO4: Following this course, students will be able to describe a project life cycle and skilfully map each stage in the cycle. Students will describe the time needed to complete a project, considering factors such as task dependencies and task lengths. Students can develop a project scope while considering customer requirements and internal/external goals.

Paper -4

CHY-10043: Photo inorganic Chemistry

Paper Type: Theory **Total Hours: 60**

Paper Type: Elective Paper -II **Total Credits: 4**

Objective:

Explain the theory and practice of common photochemical and photophysical methods, and be able to execute these experimentally. Also explains the theory and application of photocatalysis and the environmental impact of Atmospheric photochemistry

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Describe the interaction of excited states with their surroundings, and apply theoretical methods for treating excited states.

CO2: Explain and discuss theories for photoinduced electron transfer and excitation energy transfer, and apply these methods in quantitative calculations

CO3: Explain the mechanisms of common photochemical transformations, analyse them theoretically, and describe the significance of conical intersections in photochemical reactions.

CO4: Describe photoinduced processes in semiconductors, and explain how these can be used for photophysical energy conversion.

Paper -4

CHY-10044: Heterocyclic Chemistry

Paper Type: Theory **Total Hours: 60**

Paper Type: Elective Paper -II **Total Credits: 4**

Objective:

Their importance in biology, heterocyclic compounds also find wide applications in diverse areas, such as in dyes, photosensitizers, coordination compounds, polymeric materials, and many more to mention.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: This course aims to provide a theoretical understanding of heterocyclic chemistry.

CO2: Explain the nomenclature, synthesis and reactivity of heterocyclic compounds.

CO3: Discuss the different strains, interactions and conformational aspects of nonaromatic heterocycles.

CO4: It includes various methods for ring synthesis and applying those methods for preparing specific groups of heterocyclic systems.

CO5: The students will be made familiar with particular properties, reactions, and applications of the most important as well as less common heterocycles

CO6: Will learn the key applications of various heterocyclic compounds in diverse fields.

Practical

CHY- 1005: Practical (Organic, Inorganic & Physical Chemistry)

Paper Type: Practical **Total Hours: 270Hrs**

Paper type: core **Total Credits: 4**

Objective:

Impart training in operating different instruments used to analyse various chemical constituents.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Detection of less common metal ions.

CO2: Separation of cation and anion by paper chromatography and column chromatography-ion exchange.

CO3: Preparation of inorganic compounds and their studies by I.R., Electronic spectra, and Mossbauer spectroscopy

CO4: Multi-step synthesis of Organic compounds.

CO5: Phase equilibria.