The Programme Outcomes of B.Sc (Honours: Chemistry) are:

On completion of the programme

- Students should have a working knowledge of the main areas of chemistry: organic, inorganic, analytical, and physical.
- Students should possess critical thinking and problem solving abilities.
- Students should be able to describe, both in writing and orally, chemical processes and procedures.
- Students know the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals.
- Students will demonstrate an awareness of the impact of chemistry on the environment, society, and other cultures outside the scientific community.
- Students will obtain employment in an appropriate field or continue education in professional and/or post-graduate institutions.

Programme specific outcomes:

- Collaborate effectively as part of a team to solve problems, debate different points of view, and interact productively with a diverse group of team members.
- Students will be able to explain why chemistry is an integral activity for addressing social, economic, and environmental problems.

The Programme Outcomes of M.Sc (Chemistry) are:

On completion of the programme

- Students will demonstrate an understanding of major concepts in all five major disciplines of chemistry: analytical, biochemistry, inorganic, organic and physical.
- Students will employ critical thinking and the scientific method to design, carry out, record and analyze the results of chemical experiments.
- Students will demonstrate proficiency in the use of appropriate instrumentation to collect and record data from chemical experiments.
- Students will demonstrate proficiency in writing and speaking about chemistry topics in a clear and concise manner to both chemists and non-chemists according to professional standards.
- Students will know and follow proper procedures and regulations for safe handling, use, and disposal of chemicals.
- Students will effectively and respectfully communicate and collaborate with colleagues.
- Students will contribute their own knowledge and experiences to their community and the broader society by participating in professional and/or community activities.

- Students will have ability to enter research and teaching as career after completing further higher studies by qualifying examinations conducted for the purpose.

Programme specific outcomes:

- Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.

The Programme Outcomes of M.Phil (Chemistry) are:

On completion of the programme

- Students will demonstrate proficiency in the use of appropriate library searching and retrieval methods to obtain information about a topic, chemical, chemical technique, or an issue relating to chemistry.
- Students will have the ability to use computers for chemical simulation and computation.
- Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.

Programme specific outcomes:

- Effectively communicate the techniques and results of laboratory experiments/research through effectively written reports and oral presentations.

The Programme Outcomes of Ph.D in Chemistry are:

- Students will gain an advanced level understanding of the field of research and to those related to it.
- Students will have strong professional foundations through activities such as teaching, internships, fellowships, and grant applications for projects.
- Students should be able to effectively communicate the results of their scientific research in writing and in oral presentation.
- Students should acquire the tools to become fully independent chemical researchers.They should be able to synthesize advanced material from the different areas of chemistry and formulate and carry out a research project that can lead to publication(s) in a refereed journal.

Programme specific outcomes:

- Students will be able to function as a member of an interdisciplinary problem solving team in a research organization.

Course Outcomes-Chemistry

Programme: B.Sc-(PCM): Sem-III:

Course: Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic

On successful completion of this course, students should be able to:

1. Enumerate thermodynamics of ideal solutions.
2. Make out what is phase equilibrium and its applications.
3. Define conductance
4. Employ conductance measurements for determining the solubility and solubility products of sparingly soluble salts and ionic product of water.
5. List the methods of preparation & reactions of Carboxylic acids, Esters and Amides.
6. List the methods of preparations & reactions Amines and Diazonium Salts
7. State the different methods of synthesis and preparation of important biomolecules Amino Acids, Peptides and Proteins.

Programme: B.Sc-(PCM): Sem-IV:

Course: Transition Metal & Coordination Chemistry, States Of Matter & Chemical Kinetics

On successful completion of this course, students should be able to:

1. Correlate the properties like oxidation states, colour, magnetic properties, lanthanide contraction of Transition Elements and Lanthanoids and actinoids with Electronic configurations.
2. Enumerate the important points of Crystal Field Theory.
3. Apply Kinetic Theory of Gases to derive with various gas laws.
4. Appreciate viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer.
5. Define the rates of chemical reactions.
6. Outline the effects of temperature, pressure, catalyst and concentration on reaction rates in Chemical Kinetics.

Programme: B.Sc-Hons: Sem-VI:

Course: Inorganic Chemistry-VI (B.Sc-VI Semester)

On successful completion of this course, students should be able to:

1. Demonstrate an understanding of medicinal compounds and drugs, their properties and mechanism of action.
2. Define different terms pertaining to medicinal chemistry
3. Interpret QSAR and ADMET of drugs and find correlation with their mechanism of action.
4. Explain the role of protein as drug receptors and enzymes as inhibitors.
5. Infer the importance of combinatorial synthesis in the development of drugs.

Course: Spectroscopy (B.Sc-VI Semester)

On successful completion of this course, students should be able to:

1. List the vibrational frequencies of organic compounds and functional groups and the effect of interactions like hydrogen bonding and solvent.
2. Demonstrate an understanding of Raman spectra of diatomic and polyatomic compounds.
3. Interpret structural features from mass spectra and EPR of different compounds.
4. Analyze and interpret NMR spectra of organic compounds and their structures.
5. Outline the importance of all branches of spectroscopy in the interpretation of the structure of compounds.

Course: Polymer Chemistry (B.Sc-Hons: Sem-VI)

On successful completion of this course, students should be able to:

1. Appreciate what is polymer and polymerization?
2. Outline the kinetics and mechanism of polymerization.
3. Compare the different techniques of polymerization and degradation of polymers.
4. Contrast the properties of different industrially important polymers.
5. Assess the use of additives and some industrially important process to convert plastic to utility items.

Course: Inorganic materials of Industrial importance (B.Sc-Hons: Sem-VI)

On successful completion of this module, students should be able to:

1. Enumerate glass and its properties and different kinds of glass.
2. Illustrate the use of ceramics in industry.
3. Analyse the use of different compound as superconductors.
4. Discuss about Portland cement and its properties.

5. Compare the use and properties of different surface coatings-dyes, pigments and paints.

Programme: M.Sc

Semester-I

Course: Recent Developments in Organic Chemistry-I (CYMS102)

On successful completion of this course, students should be able to:

1. Demonstrate an understanding of the effect of the electronic structuture on chemical bonding and aromaticity.
2. Enumerate thermodynamics and kinetics of chemical reactions.
3. Interpret configuration and conformational analysis of organic compounds.
4. Explain nucleophilic substitution and elimination reactions.
5. Predict the mechanism of addition reaction of unsaturated systems.

Course: Advanced Inorganic Chemistry (CYMS101)

On successful completion of this course, students should be able to:

1. Define different terms pertaining to symmetry in molecules.
2. Predict point symmetry group of molecules based on its symmetry elements.
3. Outline the structuture, properties and reactions of transition metal carbonyls and nitrosyl complexes.
4. Interpret magnetic behavior of transition metal complexes from the electronic structure.

Course: Course: Advanced Physical Chemistry- IV (CYMS 102)

On successful completion of this course, students should be able to:

1. Appreciate the basics of thermodynamics
2. Interpret partial molar properties and its variation with temperatures and pressure.
3. Enumerate the chemical potential of the system
4. Interpret valence bond and molecular orbital theory for diatomic molecules.
5. Outline Huckel MO treatment for simple and conjugated polyenes.
6. Identify crystal system and different types of crystal defects.

Course: Application of Mathematics and Computers in Chemistry (CYMS104)

1. Evaluate the significant characteristics of data obtained in experiments.

2. Intererpret data by statistical tools like correlation analysis scatter diagram and least square analysis.
3. Demonstrate understanding of mathematical tools like differentiation, intrgration, matrix, differential equation and logarithm as required for chemists.
4. Recognize the importance computation in chemistry.
5. Construct algorithms and flow charts for relevant problems.
6. Recognize important features of computer high level languages like Fortran and C.

Course: Spectroscopic Techniques-I (CYMS105)

1. List the electronic transitions and vibration frequencies of organic compounds with different functional groups
2. Enumerate the effects of interactions like hydrogen bonding and solvent in the electronic and IR spectra.
3. Demonstrate an understanding of Raman spectra of diatomic and polyatomic compounds.
4. Interpret structural features of different compounds from mass spectra and EPR.
5. Analyze NMR spectra of organic compounds from its structures.
6. Interpret spectral data to predict the structure of compounds.

Laboratory Courses (CYMS 105)

Course: Lab (Part-a) Inorganic Chemistry Practical-I

On successful completion of this course, students should be able to:

1. Carry out gravimetric titration to quantitatively determine Silica and volumetrically Fe in an ore.
2. Determine of Cu iodometrically and Fe volumetrically in a given sample of Copper Ferrite.
3. Determine capacities of cation and anion exchange resin in terms of milliequivallents/g of dry resin
4. Know how to prepare Copper pyrites and determine percentage yield of Copper Ferrite.

Course: Lab (Part-a) Organic Chemistry Practical-I

On successful completion of this course, students should be able to:

1. Execute separation of compounds and qualitative identification of compounds.
2. Carry out the following synthesis:
   (a) acetylation of chlorestorol to prepare cholesteryl acetate.

(b) Oxidation of adipic acid by chromic acid
(c) Use of Grignard reagent to prepare triphenyl methanol from benzoic acid.
(d) Aldol condensation to Dibenzal acetone from benzaldihyde
(e) Sandmeyer reaction to prepare p-chlorotoluene from p-toluidine
(f) Acetoacetic ester condensation to Preparation of ethyl-n-butylacetoacetate
(g) Haloform reaction to for preparation of iodoform from acetone

3. Perform preparation of anthranilic acid, floroscine and methyl orange in the laboratory.

Course: Physical Chemistry (Part-C)

1. Operate potentiometer to determine
   (a) Normality of each acid in a given mixture of strong acid and weak acid.
   (b) Solubility and solubility products salts of silver like AgCl,AfBr and AgI

2. Carry out conductometric experiments to find out:

   (a) Normality of strong acid from mixture of strong acid and weak acid
   (b) Relative strengths of chloroacetic acid and acetic acid.

3. Ability to do colorimetric experiments to verify Beer-Lambert law for copper-ammonia complex and determine unknown copper ion concentration

4. Carry out thermometric measurement to determine heat of solution of simple salts like KCl, NaCl,$MgCl_2$ in 1M solution and that of sparingly soluble salt like benzoic acid by solubility measurements.

Semester-II:

Course: Recent Developments in Organic Chemistry II (M. Sc. Chemistry II Sem)

On successful completion of this course, students should be able to:

1. Reproduce the mechanisms of important molecular rearrangement reactions.
2. Be able to explain the important organic reactions with mechanism & their application.
3. Outline synthetic strategy, disconnection & chemo selectivity of the reactions.
4. Appreciate role and mechanism of action of protecting functional groups in organic chemistry.

Course: Laboratory Course-II

On successful completion of this course, students should be able to:

Part-a: Inorganic Chemistry-Practical –II

1. Determine the amounts of Zn and Fe present in a sample of zinc ferrite volumetrically and complexometrically respectively.
2. Determine the influence of surface area and time on the rate of corrosion process.
3. Estimate the amount of cadmium and zinc from mixture by anion exchange chromatic method.
4. Preparation of zinc ferrite and pentathiourea dicuprous nitrate to determine the percentage yield.
5. Estimation of the phosphoric acid in cola drinks by molybdenum blue method.

Part-b: Organic Chemistry Practical-II

1. Perform the following quantitative analysis:
   (a) determine the percentage and number of hydroxyl groups in organic compound by acetylation method.
   (b) Estimate amines and phenols using bromated-bromide and acetylation method

2. Determine iodine and saponification value of an oil sample.

3. Perform laboratory experiments to determine dissolved oxygen, COD and BOD of water samples.

4. Carry out multi-step synthesis by the following reactions:

(a) Cannizzaro reaction using 4-chlorobenzaldehyde as substarte

(b) Benzilic acid rearrangement:benzilic acid from benzaldehyde via benzoin and benzil intermediates respectively.

© Hofmann bromamide rearrangement: Anthranilic acid from pthalic anhydride vis pthalimide intermediate.

(d) Beckmann rearrangement: Benzophenone from benzene.

5. Perform phase transfer catalysis using diethyl malonate or ethy acetate and alky halide.

Part-C: Physical Chemistry-II

1. Construct phase diagram for three component system containing C_2H_5OH,C_6H_6 and H_2O.
2. Use colorometry method to find out concentration of ammonia in an unknown solution.

3. Perform potentiometry to find out redox potential of Fe^{+3}/Fe^{+2} sysytem and amount of halide in a given ixture of KCl and KBr.
4. Determine the solubility of PbI_2 in presence of different concentrations of KNO3 and KCl respectively.
5. Determine the solubility of sparingly soluble salts like PbSO4,AGIO3 and Ag2CrO4 through conductometric experiments.
6. Coductometrically verify the Onsager equation at low xconcentartion for 1:1 type electrolyte.

Course: Bio-organic chemistry (CYMS203)

On successful completion of this course, students should be able to:

1. Appreciate deleterious effects of excess metals like mercury, lead and arsenic in the environment.
2. Classify vitamins as water soluble and fat soluble vitamins.
3. Demonstrate an understanding of the structures of vitamins with their mechanism of action in human bodies.
4. Interpret the cause of the AIDS disease from genetic changes in human bodies due to the HIV.
5. Recognize the structure of the anti-AIDS drugs.
6. Discus the structure and properties of amino acids.

Course: Chromatographic and separation techniques (CYMS204)

On successful completion of this course, students should be able to:

1. Determine appropriate chromatographic technique for chemical analysis
2. Comprehend the optimization of chromatographic methods
3. Evaluate the quality of acquired data to predict the compounds
4. Explain the principles electro-migration techniques of the most important liquid and gas chromatography.
5. Evaluate strengths and limitations of the most important chromatographic separation and detection methods in relation to the properties of the sample and of the analysis task.
6. Report chromatographic analyses in a scientifically sound and understandable (intelligible) way.

Semester-III

Course: Pericyclic and photochemistry (CYMS 301)

On successful completion of this course, students should be able to:

1. Compare different pericyclic reactions and their mechanism.
2. Outline different physical processes of photochemistry.
3. Enumerate photochemistry of alkenes.
4. Interpret the photochemical reactions of ketones
5. Explain important photochemical reactions undergone by aromatic compound

Course: Polymer Chemistry and organometallic compounds (CYMS 303)

On successful completion of this course, students should be able to:

1. Classify polymers based on its structure.
2. Enumerate different properties of polymers.
3. Identify different important monomers and their manufacturing process.
4. Evaluate the application and the synthesis of polymers.
5. Outline the preparation and properties of transition metal complexes and organometallic compounds of main group elements.

Course: Heterocyclic chemistry (CYMS302)

At the end of the course, students should be able to:

1. Familiar with the structures of important classes of heterocyclic aromatic organic compounds.
2. Classify simple heterocyclic aromatic compounds as electron deficient or electron rich and explain their reactivity based on these properties.
3. Know how selected organometallic reactions can be applied in heterocyclic chemistry.
4. Explain on a mechanistic level, reactions and synthesis of important electron deficient nitrogen containing heterocycles; pyridines, diazines and their benzo-condenced analogs.
5. Explain on a mechanistic level,the reactions and synthesis of important electron rich heterocycles like furans, pyrroles and thiophenes and 1,3-azoles, and benzo-condensed analogs.

Course: Recent Developments in Organic Chemistry-III(CYMS 304)

1. Appreciate what is phase transfer catalysis and its types and mechanism of action
2. Outline the methods of preparation of PTCs like macrocyclic ether,quartenery salts,tetrahexyl ammonium bromide,hexa decyl tributylphosphonium bromide and their applications in organic synthesis.
3. Explain microwave spectroscopy for diatomic molecules considering it as rigid rotor.
4. Calculate bond-length and bond –energy from rotational spectra of diatomic molecules.
5. Outlines the principle of working of microwave spectrophotometer.
6. Know the types of sonochemical reactions and their synthetic applications and polymer supported reagents.
7. Appreciate different aspects of research methodology for carrying out research systematically.

Laboratory Courses (CYMS-305)

Course: Lab (Part-a): Organic preparation and separation of organic compounds

1. Separate and identify organic compound from a mixture through systematic study.
2. Carry out recrystallisation of compounds; find out melting point and naming of compound referring to literature.
3. Prepare an organic compound through a single step reaction or multi-step reactions through intermediate.

Course: Lab (Part-b): Spectroscopic Identification and chromatographic separation of organic compounds

1. Interpret data of UV, IR , ^{1}H NMR, ^{13}C NMR and Mass spectra to identify organic compounds.
2. Carry-out chromatographic techniques of TLC and column chromatography to separate and identify compounds from mixture from their R_f values.

Course: Lab (Part-c):Biological Activity Lab

1. Run and operate microbiology lab equipments like microscope, incubators and shakers.
2. Carry-out electrophoresis experiments.
3. Prepare culture media, slides and staining of slides
4. Ability to sample and quantify microorganism in air, soil and water.

Semester: IV

Course: Spectroscopic techniques II (CYMS 403)

On successful completion of this course, students should be able to:

1. List the vibration frequencies of organic compounds and functional groups and the effect of interactions like hydrogen bonding and solvent.
2. Demonstrate an understanding of Raman spectra of diatomic and polyatomic compounds.
3. Interpret structural features from mass spectra and EPR of different compounds.
4. Analyze and interpret NMR spectra of organic compounds and their structures.
5. Outline the importance of all branches of spectroscopy in the interpretation of the structure of compounds.

Course: Recent Developments in Organic Chemistry IV (CYMS 402)

On successful completion of this course, students should be able to:

1. Outline the classification, nomenclature and brief idea of drugs.
2. Elucidate structure of drug receptors & mechanism of drug action.
3. Explain the importance role of supramolecular chemistry in organic chemistry, chemical biology, materials science and nanotechnology.
4. Enumerate non-covalent interactions, molecular recognition and self-assembly.
5. Describe important applications of supramolecular chemistry particularly in dynamic combinatorial chemistry, materials chemistry (e.g. soft materials), biological systems and the construction of nanoscale entities.
6. Classify nanoparticles based on their structures.
7. Outline the applications of nano-particles in sensors, catalysis, cells and drug delivery.

Course: Natural Products (CYMS401)

On successful completion of this course, students should be able to:

1. Identify and characterize various classes of natural products by their structures.
2. Appreciate the biogenesis of many natural products of importance.
3. Have some knowledge of some of the plants around them and their pharmaceutical importance.

4. Have some knowledge of bacteria, fungi and other life forms from which useful pharmaceuticals are derived.
5. Have acquired the skills to understand the isolation and purification of simple products that are derived from plants and some animals.
6. Students will become familiar with various types of natural products produced by plants, microorganisms, and from marine sources together with applications in medicinal chemistry.

Course: Major Project

On successful completion of this course, students should be able to:

1. To make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
2. Acquire the skills to communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms.
3. Collaborative skills through working in a team to achieve common goals.
4. Attain the skill to learn on their own, reflect on their learning and take appropriate actions to improve it.

Course: Seminar

On successful completion of this course, students should be able to:

1. Develop a relevant and informed opinion, or point of view, that is appropriate for its audience and purpose.
2. Demonstrate effective writing skills and processes by employing the techniques of academic writing, including invention, research, critical analysis and evaluation, and revision.
3. Understand the role that effective presentations have in public/professional contexts and gain experience in formal/ informal presentation.