

**PROGRAM OUTCOME
PROGRAM SPECIFIC OUTCOME
AND
COURSE OUTCOME**

**DEPARTMENT OF CHEMISTRY
BIDHAN CHANDRA COLLEGE
ASANSOL - 713304**

PROGRAM OUTCOME

The program outcome of the undergraduate honors course in science is to provide the key theoretical knowledge base and to develop laboratory skills. Students should not only be prepared for higher studies in the field of science and for careers as professionals in science and allied fields, but also for professional schools like pharmacies, polymers, paints, cosmetics, fabrics, packaging *etc.*

As for the undergraduate program course in science the student should be familiar with the basic principles of science and laboratory techniques to facilitate their studies in different other branches of science.

PROGRAM SPECIFIC OUTCOME

On successful completion of the course in chemistry, students will be able to:

1. Apply current chemical and scientific theories including those in Inorganic, Organic, Physical and Analytical chemistries due to a proper grasping of the fundamentals.
2. Carry out scientific experiments as well as accurately record and analyze the results of such experiments.
3. Solve problems, think critically and apply analytical reasoning to scientific problems.
4. Gain interest in exploring new areas of research in both chemistry and allied fields of science and technology.
5. Appreciate the central role of chemistry in our society and use this as a basis for ethical behavior 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. Explain why chemistry is an integral activity for addressing social, economic, and environmental problems.
7. To function as a member of an interdisciplinary problem-solving team.

COURSE OUTCOME

CHEMISTRY HONORS

SEMESTER – 1

BCHEM 0101-Inorganic Chemistry 1

- The students are imparted with moderate level knowledge on atomic structure and subsequent development of nuclear chemistry.
- They gain a comprehensive knowledge on the periodicity and periodic properties of elements.
- They will partake concrete concepts regarding hybridisation and its associated theories like the VSEPR, and their subsequent application to covalent molecules.
- They will understand different chemical properties of the molecules after gaining knowledge about MO theory

BCHEM 0102-Organic Chemistry 1

- Students acquire subsequent knowledge on the classification and nomenclature of different organic compounds
- Gathers knowledge on structure, bonding and properties of organic molecules
- Gets a brief introduction to organic reaction mechanism, reaction intermediates and kinetics of different chemical reactions
- Gets acquainted with aliphatic and aromatic nucleophilic substitution reaction.
- The students gain a reasonable knowledge of configuration and conformation of organic molecules, elements of symmetry and molecular chirality.

SEMESTER – 2

BCHEM 0201-Physical Chemistry 1

- The students gain comprehensive knowledge on gaseous properties and behavior of real and ideal gases.
- Gets a grasp on the basic formalism and concepts of 1st law of thermodynamics and acquires problem solving skills related to thermochemistry and elementary thermodynamics
- Gets acquainted with the general and flow properties of fluids and their experimental determinations.

BCHEM 0202-Physical Chemistry-1 Lab

- The student gains practical knowledge on some experiments on flow properties of fluids.

BCHEM 0203-Organic Chemistry 2

- Students get basic idea about stereochemistry specifically on prochirality, topic relationship of ligands or faces, preliminary concept of asymmetric synthesis, symmetry and chiroptical properties of different conformers of substituted cyclohexane.
- Acquires an idea on reaction mechanism and stereochemical aspect of elimination reaction and electrophilic addition reaction of unsaturated compound (C-C).
- Gains brief knowledge on carbonyl chemistry.

BCHEM 0204-Organic Chemistry-2 Lab

- Students get a complete knowledge of laboratory experiment on identifying the special elements, and detection of functional group present in the compound. This laboratory experiments have a scope to perform the comparative study with literature through suitable derivatization of functional group and study of melting point.

SEMESTER – 3

BCHEM 0301-Inorganic Chemistry 2

- Students will learn the chemistry of s and p block elements including comparative property analysis which encompass spectral, magnetic and catalytic properties as well. At the end to brush up their understanding they learn about some representative compounds of the elements.
- Isolation and separation of rare earth metals will also be learnt here.
- Students will recall their memories regarding various theories of acid and bases. It will be applied to elaborate various characteristics of the inorganic compounds.

BCHEM 0302-Inorganic Chemistry-2 Lab

- Gets a first-hand training on qualitative analysis of inorganic radicals from salt mixtures by knowing the underlying basic chemistry of the elements.

BCHEM 0303-Organic Chemistry 3

- Students will study the reaction mechanisms involved in a variety of Named reactions and gather comprehensive knowledge on molecular rearrangements involved.
- Study thoroughly the mechanism, orientation and reactivity of certain Named reactions and in the process gather explicit knowledge on aromatic electrophilic substitution mechanism
- Acquire concrete knowledge on synthesis, physical properties and reactions involving aliphatic and aromatic nitrogen compounds

BCHEM 0304-Organic Chemistry-3 Lab

- Gain first-hand knowledge while practicing and learning the concepts associated with organic quantitative analysis, involving estimation of glucose by Fehling's solution, estimation of aniline and also acetone

BCHEM 0305 Physical Chemistry 2

- Students acquire subsequent knowledge on the concepts of 2nd and 3rd laws of thermodynamics and in the context a preliminary idea on statistical thermodynamics
- Gets a brief introduction on the laws of kinetics, chain reactions and temperature dependence of rates. Also acquires problem solving skills related to numerical problems.
- Gets a brief idea on ionic equilibria and acid-base concepts
- Gathers primary knowledge on the structure and properties of solids and subsequent problem solving.

BCHEM 0306-Physical Chemistry-2 Lab

- Students gain knowledge and develop skills on performing experiments on solubilities and first order kinetics.

BCHEM 0307-Industrial Chemistry-SEC

- Students will familiarize themselves with the types of the most universal solvent water and understand its uses, techniques for using it different industrial processes and its necessity
- Will get first-hand knowledge on the properties, uses and methods of preparations of different chemicals relevant in electrochemical, electrothermal, ceramics, iron and steel industries
- Gain preliminary knowledge on industrial safety and fire protection
- Gain comprehensive knowledge on industrial pollution and its prevention

BCHEM 0308-Pharmaceutical Chemistry-SEC

- Students will gather primary knowledge on the drug discovery, design, development and laboratory synthesis methodologies of some common class of drugs like analgesics, antipyretics, anti-inflammatory, antibiotics, antifungal, CNS agents, cardio-vascular and HIV related drugs.
- Familiarize themselves with the types of fermentation and its employment for production of some common drugs and vitamins

SEMESTER – 4

BCHEM 0401-Inorganic Chemistry 3

- Students will learn extensive d and f block metal chemistry. Some representative metal chemistry will also be learnt here.
- They will have the flavor of coordination chemistry. Gaining requisite knowledge about bonding and fundamental properties of the complexes they will be proficient in explaining various inorganic reactions.

BCHEM 0402-Inorganic Chemistry-3 Lab

- Will gather hands-on training along with theoretical knowledge about the preparation of some simple complexometric inorganic compounds.

BCHEM 0403-Organic Chemistry 4

- Students will acquire comprehensive knowledge on the synthesis, properties and uses of some typical heterocyclic compounds
- Learn the details on the chemical aspects of simple alicyclic ring structures, up to six-membered ones
- Gain comprehensive knowledge on the synthesis and structure of essential and non-essential amino acids as also proteins
- Study elaborately on the chemistry of carbohydrates
- Will accrue an elementary knowledge base on alkaloids and terpenoids with respect to some typical exemplifications.

BCHEM 0404-Organic Chemistry-4 Lab

- Students will learn to identify on the basis of some general reactions and tests a few designated organic compounds

BCHEM 0405-Physical Chemistry 3

- The students gain a reasonable knowledge on thermodynamic equilibrium and the allied laws and concepts.
- Gets a systematic and primarily exhaustive clutch on the principles, concepts, problems and experimentations on electrochemistry and allied fields

- Gets acquainted with advanced topics of chemical kinetics particularly reaction theories.
- Will understand the preliminary concepts and ideas on interface and dielectrics

BCHEM 0406-Physical Chemistry-3 Lab

- Will be able to study and perform experiments on equilibrium and electrochemistry and subsequently analyze the results.

BCHEM 0407-Chemistry of Cosmetics and Perfumes-SEC

- Will make a general study on the preparation and uses of some common cosmetics and perfumes.

BCHEM 0408-Fuel Chemistry-SEC

- Students will assemble elementary knowledge on the sources, classification, calorific values, extraction and purification methodologies, by-products, uses and chemistry of coal and petroleum
- Will gain a preliminary knowledge on the classification, preparation, properties and uses of lubricants.

SEMESTER – 5

BCHEM 0501-Organic Chemistry 5

- Will get first-hand knowledge on the different methodologies used in organic synthesis.
- The students gain a subsequent knowledge of pericyclic reaction mechanism of different organic reactions.
- Familiarize themselves with different spectroscopic methods including Ultraviolet spectroscopy, Infrared spectroscopy and Proton NMR spectroscopy and utilize the spectroscopic methods in structure elucidation of simple organic molecules.

BCHEM 0502-Organic Chemistry-5 Lab

- The students gain practical knowledge on some of the common reactions like condensation, nitration, oxidation, hydrolysis and rearrangement.

BCHEM 0503-Inorganic Chemistry 4

- Students gain knowledge about redox chemistry, particularly the application of redox potential and redox equilibrium in inorganic reactions, electrochemical cell and application of redox chemistry in different fields of inorganic reactions and their subsequent industrial applications.
- They will first assemble the idea of bio-inorganic chemistry, which will then guide them about the role of different metal ions in biosystems and as well as their toxicity and in the process understand the logical field that bioinorganic chemistry and biomolecules have with metals as a key functional moiety.
- Gain comprehensive knowledge regarding organometallic chemistry and their different applications particularly as catalysts for large scale industrial purposes.

BCHEM 0504-Inorganic Chemistry-4 Lab

- Students will assemble the primary knowledge about estimation different elements in mixture like Fe + Cu, Fe + Cr, Fe + Ca, Ca + Ba, Ca + Mg etc. using redox principle.
- They are made proficient in volumetric analysis by redox titration such as permanganometry, dichromatometry, iodometry and iodimetry.
- They will gain knowledge on precision in quantitative estimation of binary mixtures

BCHEM 0505-Green Chemistry-DCE

- Students will be introduced to the elementary concepts of green chemistry including needs, goals and limitations of the topic.
- They will learn the twelve guiding principles of the subject along with explanations
- Typically, they will be trained to design green synthetic methodologies, by preventing and minimizing production of byproducts, use of green solvents and reagents, employ green energy sources and use of green catalytic reagents in the process
- They will study about some typical green synthetic reactions.

BCHEM 0506-Environmental Chemistry-DCE

- The students will study extensively on the composition, structure, major pollutants and their consequent detection, estimation, control and treatment of the various components of the environment, *v.i.z.*, the atmosphere, hydrosphere and lithosphere
- Learn in details on various aspects of environmental inorganic chemistry

BCHEM 0507-Solid state Chemistry-DCE

- Students will assemble the basic concepts and gain preliminary knowledge on the lattice structures, packing fraction, crystallographic parameters, ionic crystals and examples thereof
- Gain a comprehensive knowledge on the theories, concepts, general properties and energetics of ionic and non-ionic bonds with special reference to alloys and inter-metallic compounds.
- Study some elementary concepts on crystal defects, superconductivity and ferro electricity.

SEMESTER – 6

BCHEM 0601-Inorganic Chemistry 5

- Students will study in details the crystal field theory.
- They will know comprehensively about magnetochemistry and about the origin of colors in coordination compounds
- They will assimilate some elementary ideas on analytical chemistry. They will gain knowledge about various analytical techniques.

BCHEM 0602-Inorganic Chemistry-5 Lab

- Students will practice and develop skills associated with some specific techniques like solvent extraction, ion exchange etc, associated with analytical chemistry
- They will perform quantitative analysis involving complexometric and gravimetric methodologies, in metal ion mixtures.

BCHEM 0603-Physical Chemistry 4

- The students study elaborately into the concepts and models involving phase equilibria
- Gain exhaustive knowledge on colligative properties
- Learn introductory concepts on symmetry and group theory and its preliminary applications in chemistry
- Going through the history and development students will gain moderate knowledge on elementary concepts of quantum mechanics and chemistry
- Gain reasonable knowledge on photochemistry

- Adequately study concepts on atomic and molecular

BCHEM 0604-Physical Chemistry-4 Lab

- Will understand the concepts and then perform experiments on some advanced electrochemistry and spectroscopic methodologies and subsequently analyze the results.

BCHEM 0605-Chemistry of Nanomaterials-DCE

- The students gain comprehensive knowledge about the nanomaterials, particularly the characteristics of nanomaterials and various targeted synthesis for different type of nanomaterials along with applications of nanomaterials in different research fields like biomedical research as well as sensing of different metals using nanoparticles.

BCHEM 0606-Dynamic Stereochemistry-DCE

- Students will assemble elementary knowledge about regioselective and regiospecific reactions and also about chemo-selective and stereoselective reactions.
- The students gain a reasonable knowledge about the synthetic approach of a few important reactions.
- Gets a systematic and primarily exhaustive clutch on the stereochemical aspects of some organic reactions.
- Gain reasonable knowledge on alicyclic system, conformation and reactivity of cyclo-hexanes, steric and stereo electronic effects of different cyclic reactions

BCHEM 0607-Quantum Chemistry & Spectroscopy-DCE

- Starting from the basic's students will dwell deep into the advanced concepts of quantum mechanics
- Thoroughly study molecular as well as atomic spectroscopy

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CHEMISTRY PROGRAM

SEMESTER – 1

CHEMG 0101-Basics in Organic & Inorganic Chemistry

- Students will study the elementary concepts on atomic structure and radioactivity and in slightly detail on the periodic properties of elements
- Learn about the classification and functional nature of organic compounds, the various effects emerging from electron displacement in molecules and will be briefly introduced to organic reaction mechanisms

SEMESTER – 2

CHEMG 0201-Elementary Physical Chemistry & Organic Chemistry

- The students gain moderate knowledge on the concepts of kinetic theory of gases and thermodynamics including development of problem-solving skills comprehensive knowledge on gaseous properties and behavior of real and ideal gases.
- Gets a grip on the basic concepts of stereochemistry

CHEMG 0202-Organic Qualitative Practical Lab

- The student gains practical knowledge on analysis and detection in organic qualitative analysis

SEMESTER – 3

CHEMG 0301-Elementary Physical Chemistry & Inorganic Chemistry

- Students study elementary schemes and concepts on phase equilibria, colligative properties, electrochemistry, chemical kinetics and equilibria, both chemical and ionic

CHEMG 0302-Inorganic Qualitative Practical Lab

- Learn the techniques of identification of select radicals from solid salt mixtures

CHEMG 0303-Industrial Chemistry-SEC

- The students gain moderate knowledge on preparation and uses of distinctive chemicals in electrochemical, electrothermal, ceramics and iron and steel industries.
- Learn on the characteristics of water
- Get a brief impression on industrial safety measures including fire protection and pollution

SEMESTER – 4

CHEMG 0401-Inorganic Chemistry & Organic Chemistry

- The students learn about chemical forces, molecular structures, acid-base concepts including buffers and redox reactions
- Study the preparation and synthetic uses of some common organic reagents and chemicals

CHEMG 0402-Inorganic Quantitative Practical Lab

- Perform and learn the concepts associated with some simple inorganic quantitative analysis involving acid-base, redox and complexometric titrations

CHEMG 0403-Chemistry of Cosmetics and Perfumes-SEC

- Students will acquaint themselves with the preparation and uses of some common cosmetics and perfumes.

SEMESTER – 5

CHEMG 0501-Applied Chemistry-DSE

- Students will study the basics of analytical chemistry, including accuracy, precision, errors, acid-base titrations and redox titrations
- Will learn the basic principles of Green chemistry
- Will gather a general idea on colloidal states
- Accumulate comprehensive knowledge on macromolecular chemistry

CHEMG 0502-Quantum Chemistry, Spectroscopy & Photochemistry-DSE

- Students will learn some basic theories, concepts, and experimentations of quantum mechanics
- Get a glimpse of atomic, molecular as well as NMR spectroscopy

CHEMG 0503-Pharmaceutical Chemistry-SEC

- Students will acquire general ideas on the drug discovery, design and development of synthetic procedures for some common class of drugs and pharmaceuticals
- Will study in details on the process of fermentation and its subsequent application for some common drug synthesis

SEMESTER – 6

CHEMG 0601-Chemistry of Bio-molecules & Chemotherapy-DSE

- Students will study elaborately on the chemistry of carbohydrates
- Gain primary knowledge on the synthesis and structure of essential and non-essential amino acids as also proteins
- Accumulate key concepts on the synthesis, properties and uses of some typical heterocyclic compounds and study briefly on nucleic acids
- Learn in details on enzymes and associated biochemical processes
- Gain elementary knowledge on chemotherapy and associated drugs

CHEMG 0602-Advanced Inorganic Chemistry-DSE

- Students will gather knowledge about the comparative properties of different elements in the periodic table (mainly s, p and d block) with some important chemical compounds.
- Students gain primary knowledge about coordination chemistry, nomenclature and isomerism of coordination compounds and application of $K_2Cr_2O_7$, $KMnO_4$, Chrome Alum, CrO_2Cl_2 etc.
- Assemble basic ideas about extraction of Gold (Au), Silver (Ag) and Copper (Cu)

CHEMG 0603-Fuel Chemistry-SEC

- Students will gather primary knowledge on the sources, classification, calorific values, extraction and purification methodologies, by-products, uses and chemistry of coal and petroleum
- Will know some of the basics related to classification, preparation, properties and uses of lubricants.