

B. Sc.

Department of chemistry

Goals

It may be obvious that a Chemistry background is important if anyone is planning to teach or to work in the chemical industry. Graduate with Bsc in chemistry can find work in pharmaceutical and chemical industries as well as in the plastic and agrochemical industries, forensic science and other field. Thus, a chemistry degree can be effectively combined with advanced work in other field.

Program outcome (PO)

- PO-1:** To provide a broad foundation in chemistry that stresses scientific reasoning and analytical problem solving with a molecular perspective.
- PO-2:** The student will understand the importance of fundamental and application of chemical theories of organic, inorganic, physical and analytical chemistry.
- PO-3:** Students will understand the interdisciplinary nature of chemistry and to integrate knowledge of mathematics, physics and other discipline to a wide variety of chemical problems.
- PO-4:** Students will learn the laboratory skills needed to carry out scientific experiments such as to design, synthesize, and characterization of novel molecule.
- PO-5:** Students will appreciate this chemistry subject which links so many scientific disciplines through application and examples as well as practical learning.
- PO-6:** To bring social and economical awareness of tribal students and change their attitude by inculcating the scientific temperament in the students and outside the scientific community.

Program Specific Outcome (PSO)

After successful completion of course the student will be able to

- PSO-1:** have sound knowledge about fundamentals and applications of chemical scientific theories;
- PSO-2:** apply appropriate techniques for qualitative and quantitative analysis of chemicals in laboratories. Handling of basic equipments, acquiring technical skills accurately and effectively communicate scientific ideas in graphic, oral and written form;

PSO-3: gain knowledge to link chemistry with other discipline;

PSO-4: develop technical skills required for synthesis, identification and structural characterization of chemical compounds:

PSO-5: understand the cause of environmental pollution and can open up new methods for environmental pollution control

F.Y.B.sc.

Sem-1 BSC0C102: General Chemistry

At the end of the course student will be able to

CO-1: understand atomic structure using theory of Schrodinger equation of quantum mechanics. They also study radial and angular part of wave function.

CO-2: study significance of quantum numbers in determining energy, shape, magnetic property and spin of electron. They also study the electronic configuration of the atom by three rules for filling electrons in various orbital according to their energy level.

CO-3: Distinguish types of bond present in molecule and theory according to bond present in molecule. I.e. for ionic bond, Born-Landé equation and Born-Haber cycles. For Covalent bond VBT and VSEPR theory. Determination of Bond Order by LCAO method.

CO-4: Understand fundamental of organic Chemistry by electronic displacement theories, inductive effect, and Resonance and hyper conjugation. Homolytic and heterolytic bond fission. To determine shape and reactivity of organic molecule. Reactive intermediate such as carbocation, carbanion and free radical.

CO-5: Use Newman, Saw-horse and fisher projection representation in stereochemistry. They also acknowledged about configuration, Geometrical and Isomerism.

CO-6: learn Aliphatic hydrocarbons of Alkanes, Alkenes and alkynes and their method of generation and physical and chemical properties.

Sem-1 BSC0P102: Chemistry practical

At the end of the course, student will be able to

CO-1: Handle laboratory glassware and hazardous chemicals. Safety in laboratory.

CO-2: Develop skills required for qualitative analysis of Inorganic mixture.

CO-3: Develop skills for quantitative analysis using Acid-Base titration experimentally.

CO-4: Set up the apparatus properly and perform all the activities in the laboratory with neatness and cleanliness.

Sem-II BSC0C202: General Chemistry

At the end of the course, student will able to

CO-1: Study Physical aspect of chemistry by concept of chemical energies by Kirchhoff's law. They also get useful insight of entropy by third law of thermodynamics.

CO-2: Understand Chemical and ionic equilibrium , Le hotelier's principle, Ionic equilibrium of strong and weak Acid-Base and their equilibrium constant and pH for different salts. Buffer solution.

CO-3: learn preparation and electrophilic substitution reaction of aromatic hydrocarbon Benzene.

CO-4: Explain preparation and chemical properties of alkyl halides and aryl halides. Basic concept of Nucleophilic substitution reaction (SN^1, SN^2) and aromatic nucleophilic substitution reactions(ARSN).

CO-5: Understand chemical properties of alcohol , ether and phenol and their various method of generation.

CO-6: Study preparation and chemical Properties of aldehyde and ketene and their various Name reactions and their significance.

Sem-II BSC0P202: Chemistry Practicals

At the end of the course, student will able to

CO-1: understand basic laws of thermodynamics practically by performing practical of determination of enthalpy of weak acids.

CO-2: Learn basic concept of pH and their important using pH meter experimentally. Importance of pH in determination of concentration of weak acids and strong acids.

CO-3: Explain basic concept of buffer and preparation of various buffer solution of acidic buffer and basic buffer.

CO-4: Perform purification process and criteria for purity: determination of Melting Point and Boiling Point.

CO-5: Find the importance and preparation method organic compound and their reaction mechanisms and information about intermediate involved in.

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Sem- III BSCC302A: Organic Chemistry

At the end of the course, student will be able to

- CO-1:** Learn basic concept of natural product carbohydrates and amino acids and their classification and their chemical properties and synthetic approaches for their formation.
- CO-2:** Understand electrophilic substitution reaction of aromatic compound. Their effect of group , relative reactivity and classification of substitution group.
- CO-3:** Explain reaction and synthesis of Naphthalene, Anthracene and Phenanthrene.
- CO-4:** Study basic concept of heterocyclic compound. Their synthesis and electrophilic and nucleophilic reaction in five member and six member ring.
- CO-5:** Understand Acid-Base properties of organic molecule by understanding chemical reactivity and molecular structure. Difference between resonance and tautomerism.

Sem- III BSCC302B: Physical Chemistry

At the end of the course, student will be able to

- CO-1:** Understand basic concept of thermodynamics by laws of thermodynamics and their various applications. Entropy change in reversible and irreversible process.
- CO-2:** Gain knowledge about chemical kinetics by theory of reaction rate and order of reaction and molecularity of a reaction. Collision theory.
- CO-3:** learn physical property conductance and their variation with dilution for weak and strong electrolytes by theory of Kohlrausch's law of dilution and conductometric titration of Acid and Base.
- CO-4:** Distinguish between adsorption and absorption. Types of adsorption and derivation of freundlich isotherm and Langmuir isotherm and its applications,
- CO-5:** Study of ideal behavior of gases and kinetics of gases. Surface tension and its determination. Viscosity and its determination of Coefficient of viscosity.

Sem- III BSC0P302: Chemistry Practical

At the end of the course, student will be able to

- CO-1:** Develop laboratory skills for the purpose of handling different instruments; interpret result of experiments and their correlation with theory.

CO-2: Impart the students a thorough knowledge of systematic qualitative analysis of organic mixture.

CO-3: Study adsorption of given organic acid and charcoal.

CO-4: Study conductometric titration and pH metric measurement in quantitative analysis.

CO-5: Determine relative strength of mineral acids.

CO-6: Perform viscosity measurement and its applications.

Sem- IV BSCC402A: Inorganic Chemistry

At the end of the course, student will be able to

CO-1: Study basic postulates of quantum mechanics, particle in one dimensional box, ZPE, characteristics of wave function, operators and their addition, subtraction and multiplication.

CO-2: Understand basic concept and formation of Co-ordination complex by CFT and CFSE. Factor influence the magnitude of crystal field splitting. John-Teller effect.

CO-3: Distinguish between atomic orbitals and molecular orbitals, bonding and anti-bonding molecular orbitals, different MO theories.

CO-4: Understand role of solvents. Physical and chemical properties of non-aqueous solvent, liquid Ammonia (NH₃), liquid SO₂, liquid HF.

CO-5: Get insightful information and chemical properties of Sodium carbonate, Sodium bicarbonate and Sodium hydroxide.

Sem- IV BSCC402B: Analytical Chemistry

At the end of the course, student will be able to

CO-1: Explain basic concept of qualitative and quantitative analysis by understanding volumetric titration based on normality of the solution which is based upon solubility product principle and common ion effect.

CO-2: Understand insightful knowledge about organic estimation of Acid (-COOH), Amine (-NH₂), Aldehyde (-CHO) and ketone (>C=O)

CO-3: Get theoretical aspect of Acid-Base titration. Ways of determining end-point in Acid-Base titration. Types of Acid-base titration and factors determining the exact form of pH curve.

CO-4: Study theory of redox titration and its application to measure electrochemical potential.

CO-5: Explain theory of complex metric titration involving EDTA. Visual process and instrumental process of complexmetric titration

CO-6: Study factor affecting stability and formation of precipitates. Theory of relative super saturation. Mohr, Volhard and fajan's method.

Sem- IV BSC0P402: Chemistry Practicals

At the end of the course, student will be able to

CO-1: Be trained in the quantitative analysis using gravimetric method.

CO-2: Impart the students a thorough knowledge of systematic qualitative analysis of Inorganic mixture.

CO-3: Maintain records of chemicals and instrumental analysis, develop laboratory skills for the purpose of collecting, interpreting, analyzing, practical data.

CO-4: Determine hardness of water , estimation of Ni Volumetrically by Complexometric titration.

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Sem- V BSCC502A: Organic Chemistry

At the end of the course, student will be able to

CO-1: explain optical activity of compound without chiral carbon in (Biphenyls, alkenes and spiranes) by use of symmetry operation like C₂ and planarity to check symmetry of organic elements.

CO-2: have stereoselectivity and stereospecificity of organic reactions. Basic concept of elimination reaction and details about syn elimination and anti elimination.

CO-3: learn different specific inorganic reagents for organic synthetic application and their mechanism

CO-4: Understand molecular rearrangements and their different Name reactions occurring through carbocations, carbenes and nitrene and their mechanism and synthetic applications of the reaction by examples of Wolf rearrangement, fries migration, Birch reduction, oppenauer oxidation.

CO-5: Study basic concept of nucleophilic substitution at a saturated carbon atom and stereochemistry of SN¹ and SN² reactions and their relative reactivity and stereochemistry.

CO-6: get insightful knowledge organometallic compound Organomagnesium, Organozinc and Organolithium compounds and their formation and various application in chemical synthesis.

CO-7: Understand theoretical aspect of natural product carbohydrate and their classification , structure and their application of different disaccharide.

CO-8: Understand condensed five and six membered heterocycles. Preparation and reactions of Indole, Quinoline and Isoquinoline and their synthetic approaches of preparation. Also get insights about mechanism of electrophilic substitution reactions of Indole, quinolone and Isoquinolone.

Sem- V BSCC502B: Inorganic Chemistry

At the end of the course, student will be able to

CO-1: Understand knowledge about symmetry and symmetry operations and various point group belonging to different shape of different molecule.

CO-2: Use knowledge gained by theory of Valance bond theory and molecular orbital theory in example of H₂ and H⁺ and other coordination complex.

CO-3: Study concept of Boron hydride by taking example of various boranes and their structure, properties and preparation which is helpful in further M.Sc programm

CO-4: Outline kinetics of inorganic reaction mechanism. Various theories of trans effect like polarization theory, MO theory. Liability and inertness.

CO-5: Understand reaction mechanism of ligand in octahedral complex. Acid hydrolysis and base hydrolysis reaction. Electron transfer reaction. Mechanism of redox reaction

CO-6: Understand basic principle of Mossbauer spectroscopy and its experimental technique and application of Iron complex.

CO-7: Study different type of Inorganic polymers and their method of preparation, physical and chemical properties, structure and their applications.

Sem- V BSCC502C: Physical Chemistry

At the end of the course, student will be able to

CO-1: Understand various thermodynamics theory like carnot cycle, clausius-claoeyron equation which give insight about flow of heat and also give knowledge about Carnot engines efficiency.

CO-2: Explain and discuss the concept of electrochemical cell and electrolytic cell, Different type of electrode and their various application in electrochemistry. Nernt's equation and its application.

CO-3: Predict the rate of reaction up to third order reaction and role of activation energy in initiation of reaction. Heterogeneous reactions, retarded reactions.

CO-4: Understand the concept of various method of polymerization and types of polymer, Number average molecular weight, Weight average molecular weight.

CO-5: Explain detection of isotopes, different types of mass spectroscopy, radioactive analysis.
Application of isotopes in trace techniques by examples.

CO-6: Understand theoretical aspects of vibrational and rotational spectra and their applications.

Sem- V BSCC502D: Analytical Chemistry

At the end of the course, student will be able to

CO-1: Get acknowledged about history and principle, different types of transition, relative position of λ_{max} of aromatic and polynuclear aromatic hydrocarbons

CO-2: Apply theoretical knowledge of UV spectra to calculate λ_{max} of dienes and enones using Woodward-fisher rules. Calculation of λ_{max} of ketones, aldehyde and ester using empirical rules.

CO-3: Understand basic principle of IR spectroscopy, instrumentation, selection rules by various frequencies. Students will be able to understand types of bond present between two atoms by different frequencies.

CO-4: Apply Hook's law in calculating frequency and factor affecting stretching frequencies like H-bonding, Mass effect, electronic factors ring size and structural problems based on IR spectra.

CO-5: Understand basic principle of NMR spectroscopy, to determine different type of proton present in compound and factor affecting on chemical shift. Calculation of problems based on NMR spectroscopy.

Sem- V BSCSE502: Soil composition and analysis

At the end of the course, student will be able to

CO-1: Understand importance of soil, composition and formation of soil. Soil profile, macro and micro plant nutrients.

CO-2: Analyze fertility and productivity of soil by different techniques. Various method for determination of nitrogen, phosphorous and potassium in soil by flame photometry.

CO-3: Determine secondary nutrient like sulphur, calcium, magnesium and mechanical analysis of soil

CO-4: Analyze and determine total micro nutrients present in soil like manganese, Fe(II) and Fe(III) in soil, silica, soluble salt and sodium by flame photometry.

Sem- V BSC0P502: Chemistry Practicals

At the end of the course, student will be able to

- CO-1:** Develop skills required for the qualitative analysis of Inorganic mixture.
- CO-2:** Study and justify kinetics of 2nd order reaction practically.
- CO-3:** Determine degree of dissociation and dissociation constant of monobasic acid using pH metry.
- CO-4:** Determine amount of base in given mixture using conductivity meter.
- CO-5:** Determine amount of salt present in given solution using potentiometer.
- CO-6:** Develop laboratory skills for preparation of organic compound for R&D.
- CO-7:** Analyze various drugs by Thin layer chromatography.
- CO-8:** Perform estimation of unknown Acid and ester.

Sem- VI BSCC602A: Organic Chemistry

At the end of the course, student will be able to

- CO-1:** Understand concept of prostereo isomerism and chiral synthesis using Cram's rule and prelog's rule.
- CO-2:** Explain basic concept of alkaloid their occurrence and classification. General method of determining structure, analytical and synthetic evidence to prove the structure of Connine, Nicotine, Atropine and Papavarine.
- CO-3:** Introduce drugs and their definition , their classification, general method of preparation and use of antipyrine, phenacetin, Benzocaine.
- CO-4:** have general information about synthetic dye and their classification based on their applications.
- CO-5:** Define preparation of various explosive and its applications.
- CO-6:** Study importance and preparation of Aldrine, Malathioin, Methoxychlor, Parathion.
- CO-7:** Understand use of polymer and preparation of polymer and preparation of polymer via cationic and anionic polymerization. Use of Ziegler-Natta polymerization.
- CO-8:** Outline product like fat, oil and detergent and their different method of preparation and various parameter to check their bio durability.

Sem- VI BSCC602B: Inorganic Chemistry

At the end of the course, student will be able to

CO-1: Understand determination of term symbol of the ground state, pigeon hole diagram of p² and d² configuration. Hund's rule Hole formation.

CO-2: Study electronic spectra of transition metal complex. Leparate orbital and spin selection rules. Orgal diagram of d¹ to d⁹. Jahn teller distortion.

CO-3: Study different operators and important theories concerning Hermitian operator, particle in three dimensional box, the Schrödinger equation in spherical polar co-ordinates for hydrogen atom.

CO-4: Define chemical bonding by Huckel molecular orbital theory. HMO treatment to ethylene molecule, allylic cation, allylic free radical and allylic anion, Hybridization wave function of sp, sp² and sp³.

CO-5: Classify metal carbonyls into mono and polynuclear metal carbonyls and metal carbonyl hydrides. Application of IR spectra in the determination of carbonyl present in metal carbonyls.

CO-6: Explain definition, classification and synthesis and their various application of organometallic compounds of Mg, Al and Be. Structure of ferrocene and dibenzene chromium.

Sem- VI BSCC602C: Physical Chemistry

At the end of the course, student will be able to

CO-1: Discuss colligative properties. Calculation of absolute value of entropy using third law thermodynamics. Law of mass action using chemical potential, partial molar quantity.

CO-2: Explain Concentration Cell and their Classification. Activity and activity coefficient. LJP, Overvoltage, Tafel equation.

CO-3: Study Phase rule for binary system, steam distillation, zone refining.

CO-4: Understand concept of osmosis by desalination and reverse osmosis, electro dialysis, role of electrochemistry in removal of Cu, Ag and Fe from waste water to control pollution.

CO-5: have general introduction of photochemistry by laws and understanding of term like Fluorescence, Photosensitized reaction.

CO-6: Study corrosion and their chemical aspect in atmospheric corrosion and preparation of corrosion by various factor.

Sem- VI BSCC602D: Analytical Chemistry

At the end of the course, student will be able to

CO-1: Explain and define errors and their types. Ways of expressing accuracy and precision. Rejection of result. Test of significance(Q test, t-Test and F-test)

- CO-2:** Understand UV visible spectroscopy and its instrument. Wavelength selector. Accuracy and errors of spectrophotometry.
- CO-3:** Discuss principle, classification of chromatography. Gas chromatography ,instrumentation and evaluation of data. High Performance Liquid Chromatography, principle and instrumentation.
- CO-4:** Study solvent extraction by choice of solvent, distribution coefficient, distribution ration. Selective extraction and separation efficiency.
- CO-5:** Understand determination of concentration by polarography,principle and their various method.
- CO-6:** Determine potential using different type of potentiometric titration, various type of ion selective electrode and its application.
- CO-7:** have basic knowledge of emission and absorption spectroscopy. Principle, comparison and applications. Buffer solutions their type and applications.
- CO-8:** Understand theoretical aspect and mechanism involved in acid base titration, titration of salt, titration of polyprotic acid, Differential alkali titration.
- CO-9:** discuss Redox titration involving Iodine. Titration with reducing agents and oxidizing agents.

Sem- VI BSCSE602: Daily use Industrial chemistry.

At the end of the course, student will be able to

- CO-1:** have general information about cosmetics their preparation and application. Quantitative and qualitative analysis of various elements present in cosmetics.
- CO-2:** have basic knowledge of perfume. Importance of natural product in perfume industries. Synthesis and application of Musk xylene, Coumarin, Vanilline, linalone, Eugenol, Civetone, Muscone.
- CO-3:** have knowledge about ceramic industries and their important product like cement and glass. Properties, types and use of Glass and Cement.
- CO-4:** Types of Portland cement, POP, Lime and its manufacture.
- CO-5:** explain importance of food industries in today's life and role of chemistry in food industry. Various analytical technique to determine fat, sugar, protein and moisture in edible food item.

Sem- VI BSC0P602: Chemistry Practicals.

At the end of the course, student will be able to

- CO-1:** Develop skills required for qualitative analysis of inorganic mixture.

- CO-2:** Be trained to perform quantitative analysis of the radicals using gravimetric method..
- CO-3:** Determine percentage of constituent metal present in alloy brass.
- CO-4:** Investigate and justify kinetics of first order reactions practically.
- CO-5:** Determine strength of acid by titration with base using pH meter.
- CO-6:** Understand titration of Acid and Base using potentiometer.
- CO-7:** Perform conductometric titration involving precipitation of NaCl with AgNO_3
- CO-8:** Determine Concentration of chromate and Nickel ion in given solution by Colourimetry.