

**DEPARTMENT OF  
CHEMISTRY  
U.G.**

## DEPARTMENT OF CHEMISTRY

**Programme code: K**

**Programme Name: B.Sc., Chemistry**

### Programme Outcomes

1. Students aid strong knowledge in fundamentals and applications of organic, inorganic, physical, analytical chemistry and also in inter-disciplinary subjects such as Green, Nano, Environmental, Forensic, Pharmaceutical chemistry etc., (Global)
2. After the completion of the degree, they will be able to work in various fields such as cement industry, petrochemical industry, rubber industry, fertilizer industry, paint industry, food safety, research laboratory, pharma companies, schools, public sectors etc., (Global)
3. Students appreciate the great role of chemistry in day-to-day life. (National)
4. Understands the safe handling of chemicals, environmental issues and key issues that faces society through energy, health and medicine. (Global)
5. Motivate them to involve in research and tackle the new challenges. (Global)

### Program Specific Outcomes

On completion of B.Sc Chemistry Programme, the Students would be able to:

1. Explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions. (Global)
2. Perform scientific experiments skillfully by application of procedural knowledge. (National)
3. Enhance the ideas about research in chemistry and develop knowledge of significance in scientific concepts which find applications in industry, medicine and modern research. (Global)
4. Gain the knowledge of Chemistry through theory and practical. (Global)
5. Identify chemical formulae and solve numerical problems. (Global)
6. Understand good laboratory practices and safety. (Global)
7. Make aware and handle the sophisticated instruments/equipments. (National)

## Course outcomes

### SEMESTER- I

**Subject Code:** 17K11

**Course name:** INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY –I (Global)

Upon completion of the course, the students will be able to

1. State the fundamental concepts of atomic structure, explain the periodic properties and its applications.
2. Explain the formation of chemical bonding, VB theory and MO theory.
3. Understand the concepts of electron displacement effect, reaction intermediate.
4. Write the mechanism of substitution, elimination reactions.
5. Recognize kinetic theory of ideal gases, gas laws, vanderwaal's equation, Joule Thomson effect and inversion temperature.

**Subject. Code:** 17SEK11

**Course Name:** LABORATORY TECHNIQUES (National)

Upon completion of the course, the students will be able to

1. Inculcate the selection and proper use of emergency equipment (e.g., fire extinguishers, eyewash stations, safety showers, spill kits, first aid kits, fire alarms, and fire blankets).
2. Understand the techniques of semi micro qualitative analysis in the removal of interfering anions,
3. Get insight into the applications of solubility product principle, complication reactions.
4. Define concentration systems: molarity, molality, normality
5. Differentiate post precipitation and co-precipitation.
6. Explain recrystallisation of solid, experimental techniques of fractional distillation and distillation under pressure for the purification of liquids.

**Subject. Code:** 17SEK12

**Course Name:** INDUSTRIAL CHEMISTRY (National)

Upon completion of the course, the students will be able to

1. Understand the manufacturing process of matches and explain the preparation of TNT, RDX explosives.
2. Enumerate the manufacturing method of Portland cement & glass.
3. Illustrate the manufacturing methods and applications of fertilizer.
4. Explain the isolation of natural rubber, vulcanization, applications of synthetic rubber.
5. Classify plastics, knowing their preparation and applications.

**Subject. Code: 17NMK1**

**Course Name: DAIRY SCIENCE (Regional)**

Upon completion of this course, the student will be able to:

1. Explain the composition, detection of adulteration in milk and milk products.
2. Demonstrate milk processing , milk powder processing methods.
3. Comment on the preparations of butter, cheese, ghee, ice cream.

## SEMESTER-II

**Subject Code: 17K21**

**Course name: INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY –II (Global)**

Upon completion of this course, the student will be able to:

1. Illustrate the mechanism of atom bomb, hydrogen bomb formation.
2. Compare the properties of  $\alpha, \beta, \gamma$  radiations and mention the applications radioactive isotopes, carbon dating.
3. Explain acid, base concepts and be familiar with the balancing of redox equations.
4. Outline the methods of preparation in alkanes, alkenes, alkynes, aromatic hydrocarbons and its uses.
5. Give brief account on crystal systems, space lattice, unit cell, laws of crystallography, Schottky defect, Frenkel defect.

**Subject. Code: 17SEK21**

**Course Name: MEDICINAL CHEMISTRY (National)**

Upon completion of this course, the student will be able to:

1. Understand the terminology in drug chemistry: Pharmacy, Pharmacology, Pharmaco dynamics etc.
2. Explain the mode of action, applications of Anaesthetics, Analgesics, and Antipyretics.
3. Outline the need of sulphadruugs, antibiotics, antiseptics.
4. Mention the applications of barbituriacid, sulphonol, piperadol, hydroxyzine.
5. Reason out the causes for cancer and its treatment.

**Subject.Code: 17SEK22**

**Course Name: FORENSIC CHEMISTRY (National)**

Upon completion of this course, the student will be able to:

1. Tell about the basic principles of Forensic Science, identification of physical evidence, Forensic examination of hair, fiber, paints.
2. Know about the examination and identification of drugs, alcohol.
3. Get insight into finger print detection, forensic serology.
4. Understand detecting forgery in bank cheques /draft, detection of gold purity.

**Subject.Code: 17NMK2**

**Course Name: CHEMISTRY IN EVERY DAY LIFE (National)**

Upon completion of this course, the student will be able to:

1. Understand the manufacturing techniques of some of the small- scale industrial
2. Trained in preparing sambirani, phenoil, shoe polish, plaster of paris .
3. Start small scale manufacturing unit .

**Subject.Code:17K2P**

**Course Name: SEMI-MICRO QUALITATIVE ANALYSIS AND ORGANIC PREPARATIONS (National)**

Upon completion of this course, the student will be able to:

1. Analyze given inorganic mixture qualitatively and report the two cations and two anions by using semi micro quantity.
2. Identify various anions and cations through flame test.
3. Distinguish interfering radicals and follow the procedure of elimination.
4. Practice group separation to identify the cations and affirm by confirmation test.
5. Acquainted with the apparatus setup , explain the theory of reactions in the preparation of following organic compounds:
  - i. Benzoic acid from methyl benzoate, ii. Salicylic acid from methyl/ethyl salicylate, iii.Osazone from glucose

### SEMESTER-III

**Subject Code: 17K31**

**Course Name: ORGANIC AND INORGANIC CHEMISTRY (Global)**

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

1. Recognize the basic practical skills for the synthesis of alkyl halides, aryl halides and aralkyl halides.
2. Understand the evidences, reactivity and mechanism of various nucleophilic elimination and substitution reactions.
3. Recognize and draw constitutional isomers, stereoisomers, including enantiomers and diastereomers, racemic mixture and meso compounds .
4. State the principle resemblances of elements within each main group in particular alkali metals, alkaline earth metals.
5. Know the fundamentals of the chemistry of the main group elements, and important real world applications of many of these species
6. Compare the Chemical reactivity of elements in the group III to VI

### SEMESTER-IV

**Subject Code : 17K41**

**Course Name: ORGANIC AND PHYSICAL CHEMISTRY (Global)**

Upon completion of the course, the students will be able to

1. Describe different classes of alcohols and able to write down structure of phenol and phenoxide ion.
2. Form the fundamental electronic structure and bonding in carbonyl compounds
3. Explain the reactivity of carbonyl compounds with both hard and soft nucleophiles ( aldehydes and ketones)
4. Understand the physical properties and chemical constitution of liquids.
5. Know about the characteristics of adsorption and catalysis
6. Understand the concept of activation energy, steady state, and zero, first and second order rate laws.

**Subject Code: 17K4P**

**Course Name: GRAVIMETRIC AND VOLUMETRIC ANALYSIS (National)**

Upon completion of the course, the students will be able to

1. Estimate the quantities of metal cautions gravimetrically.
2. Facilitate the learner to make solutions of various molar concentrations.
3. Compute the different types of errors in practical.
4. Calculate titration errors for method evaluation, and perform statistical evaluation of results from classical and instrumental chemical experiments and analyses
5. Know how to engage in safe laboratory practices handling laboratory glassware, equipment, and chemical reagents.

### SEMESTER-V

**Subject Code: 17K51**

**Course name: ORGANIC CHEMISTRY (Global)**

Upon completion of the course, the students will be able to

1. Understand aromatic electrophilic, nucleophilic substitutions and the process of reactions.
2. Identify organic naming reactions and their mechanism.
3. Classify organic nitrogen compounds and compare the basicity of amines.
4. Summarize the preparation, properties of heterocyclic compounds and its uses
5. Define carbohydrates, mutarotaion, epimerization and discuss their structure and configuration.

**Subject code: 17K52**

**Course name: PHYSICAL CHEMISTRY-I (Global)**

Upon completion of the course, the students will be able to

1. Assess knowledge on importance of thermodynamics, Joule Thomson effect and its applications in real life.
2. Recognize the need for second law of thermodynamics, Nernst heat theorem, absolute entropy of solid, liquid, gas.
3. Define phase, equilibrium, component, degrees of freedom and Gibbs phase rule and interprets the stability regions in one component, two component, congruent melting, incongruent melting phase diagrams.
4. Describe the effect solute concentration on various properties (vapour pressure, boiling point, freezing point and osmotic pressure)
5. Identify the point group, order of the group in molecules, construct character table for  $C_{2V}$  point group

**Subject Code: 17KE5A**

**Course name: INORGANIC AND ANALYTICAL CHEMISTRY (Global)**

Upon completion of the course, the students will be able to

1. Comment on behavior of halogen compounds, peculiarities of fluorine, inter halogen compounds and their structure.
2. Explain the extraction process of titanium, molybdenum, tungsten and get insight into their compounds.
3. Understand the characteristics of lanthanides and actinides and its applications
4. Know the properties of non-aqueous solvents and inorganic polymers.
5. Develop accuracy and precision in doing experiments, understands the different types of errors and methods for minimizing errors.
6. Describe the principles of thermo gravimetric analysis, differential thermal analysis which is used to find the stability of compounds.

**Subject Code: 17SEK51**

**Course name: CHEMISTRY OF BIOMOLECULES (National)**

Upon completion of the course, the students will be able to

1. Discuss the chemistry of biomolecules: Amino acids, proteins, nucleic acids
2. Understand the functions of nucleotide, DNA, RNA and distinguish DNA and RNA structures.
3. Categorize the functions of hormones and vitamins and hormones .
4. Summarize enzyme activity and its mechanism
5. Determine saponification value, iodine value of oil.

### SEMESTER-VI

**Subject Code: 17K61**

**Course name: ORGANIC CHEMISTRY AND SPECTROSCOPY (Global)**

Upon completion of the course, the students will be able to

1. Outline the preparation , applications of active methylene compounds and dyes.
2. Apprehend the instrumentation of column , thin layer, paper chromatography
3. State Bayer strain theory, and its modification also discuss conformations of ethane, butane, 1,2-dichloroethane, cyclohexane, methyl cyclohexane
4. Label the various molecular rearrangements by understanding its mechanism.
5. Distinguish tautomerism and resonance.
6. Analyze the extraction method , elucidate the structure of alkaloids and terpenoids.
7. Calculate  $\lambda_{\max}$  values for conjugated dienes and  $\alpha,\beta$ -unsaturated carbonyl compounds.
8. Tell about finger print region, spin-spin coupling , coupling constant, Pascal's triangle.



**Subject Code: 17K62**

**Course name: PHYSICAL CHEMISTRY –II (Global)**

Upon completion of the course, the students will be able to

1. Use the Nernst equation to calculate cell potential.
2. Describe the functions of fuelcells and batteries.
3. Understand the laws of photochemistry, quantum yield and differentiate phosphorescence and fluorescence process.
4. Enumerate the postulates of quantum mechanics
5. Apply Schrodinger wave equation to particle in 1D and 3D box.
6. Elaborate on rotational spectroscopy of diatomic molecules, identify modes of vibration of polyatomic molecules in IR spectroscopy and understand the rule of mutual exclusion principle in Raman spectroscopy.

**Subject Code: 17KE6A**

**Course name: INORGANIC AND APPLICATIONS OF COMPUTER IN CHEMISTRY (Global)**

Upon completion of the course, the students will be able to

1. Understand Nomenclature, EAN rule of coordination complexes and applications of chelated complexes in analytical chemistry.
2. Calculate crystal field splitting energy, magnetic moments of transition elements.
3. Compare VBT and CFT, explain MOT of octahedral complexes.
4. Explain the role of metal ions in biological systems, functions of haemoglobin, myoglobin, chlorophyll.
5. Solve the chemistry problems with the use of C-language.
6. Represent and manipulate 2D, 3D- molecular structure using cheminformatics.

**Subject Code: 17SEK61**

**Course name: GREEN AND NANO CHEMISTRY (National)**

Upon completion of the course, the students will be able to

1. Understand the 12 principles of green chemistry.
2. Design green synthesis using appropriate materials, catalysts & green solvents to improve the sustainability of the product.
3. Brief study on applications of ultrasound and microwave in organic synthesis.
4. Outline the synthesis of nanoparticles, nanosized semiconductors, carbides, and their applications in real world.
5. Create an appreciation of how the practice of nanochemistry enhance competitiveness, innovation and faster time to market.

**Subject Code: 17K61P**

**Course name: ORGANIC ANALYSIS & ESTIMATION (National)**

Upon completion of the course, the students will be able to

1. Analyze organic compounds systematically
2. Identify of a compound as to belong to a particular class of compounds and confirm it by preparing a suitable derivative.
2. Distinguish the reactions of various functional groups.
3. Understand the theory behind the reactions of estimation of aniline and phenol

**Subject Code: 17K62P**

**Course name: PHYSICAL CHEMISTRY (National)**

Upon completion of the course, the students will be able to

1. Determine molecular weights by transition temperature method, Rast's macro method.
2. Construct phase diagram and determine eutectic composition and eutectic temperature.
3. Determine the miscibility temperature of phenol-water system.
4. Prepare the solutions of desired strength and buffer mixtures.
5. Demonstrate conductometric, potentiometric, colorimetric, and pH titrations.

**ALLIED CHEMISTRY-I**  
**U.G.**

## ANCILLARY CHEMISTRY (FOR B.SC . N&D)

### SEMESTER-III

**Subject.Code:** 17AKN3

**Course Name:** BIO CHEMISTRY (National)

### Course outcomes

Upon completion of this module, the student will be able to:

1. Classify aminoacids and proteins.
2. Differentiate between vitamins and hormones.
3. Demonstrate the concepts of structure, replication of DNA, RNA.
4. Illustrate the role of enzyme activities and its mechanism.
5. Analyse the fats using saponification value, iodine value, Reichert-Meisel value.

### SEMESTER - IV

**Subject.Code:** 17AKN4

**Course Name:** ENVIRONMENTAL AND ORGANIC CHEMISTRY (National)

Upon completion of this module, the student will be able to:

1. Define, theories and disadvantages of corrosion, how to prevent corrosion.
2. Understand and identified the dangerously toxic solids, liquids and gases ,explain
3. the biochemical effect of toxic metals in man and children.
4. Acquaint knowledge on anthropogenic sources of radiation , protection from radiation.
5. Compare and inter conversion between glucose and fructose.
6. Enumerate the preparation and applications of azo, nitro dyes.

**Subject Code:** 17AKN4P

**Course Name:** QUALITATIVE ANALYSIS (National)

Upon completion of the course, the students will be able to

1. Recognize the basic practical skills for the analysis of inorganic compounds
2. Inculcate the principle of qualitative analysis and eliminate the interfering radical.
3. Be skilful in identifying the simple salt containing one cation and anion.

## SEMESTER- V

**Subject code : 17AKN5**

**Course Name: APPLIED CHEMISTRY (Regional)**

Upon completion of the course, the students will be able to

1. Study the water management.
2. Gain basic knowledge on natural, synthetic rubber, plastics and resins
3. Study the manufacture of cement and glass by modern methods
4. Understand the function of paints and pigments.
5. Know the different plant nutrients, their functions and deficiency symptoms.
6. Identify the problematic soil and recommend a method for their reclamation.

## SEMESTER- VI

**Subject Code : 17AKN6**

**Course Name: APPLIED AND MEDICINAL CHEMISTRY (National)**

Upon completion of the course, the students will be able to

1. Study the manufacture of Soap , Detergents and paper by modern methods.
2. Know about process of dyeing leather, use of mordants.
3. Acquire knowledge about the properties and applications of colloids.
4. Know the applications of anaesthetics, analgesics, antipyretics, antibiotics.

**Subject Code: 17AKN6P**

**Course Name: VOLUMETRIC ANALYSIS (National)**

Upon completion of the course, the students will be able to

1. Perform double titrations for simple acid - base and redox titrations skilfully.
2. Identify different types of errors in quantitative analysis.
3. Calculate titration errors for method evaluation, and perform statistical evaluation of results from classical and instrumental chemical experiments and analyses
4. Make scientific reports from chemical experiments and present the results in a transparent manner.

**ALLIED CHEMISTRY-I**  
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## ANCILLARY CHEMISTRY (FOR B.SC., PHYSICS )

### SEMESTER- III

**Subject code: 17AKP3**

**Course Name: PHYSICAL CHEMISTRY (Global)**

Upon completion of the course, the students will be able to

1. Understand the symmetry aspects in chemical systems
2. Comprehend the importance of point group and its classification
3. Apprehend the basic concepts of crystallography
4. Write down the laws of photochemistry and quantum yield.
5. Explain radiative and non radiative processes using Jablonsky diagram.
6. Get insight into the basic laws governing the behavior of gases

### SEMESTER - IV

**Subject code: 17AKP4**

**Course Name: ORGANIC AND PHYSICAL CHEMISTRY (Global)**

Upon completion of the course, the students will be able to

1. Comprehend the preparation, properties, structure and importance of carbohydrates
2. Understand the fundamental properties and reactivity of biologically important molecules.
3. Understand the properties of ideal and non ideal solutions, the basic concepts of electrochemistry and its applications.
4. Construct the different types of electrochemical cells and batteries

**Subject Code: 17AKP4P**

**Course Name: QUALITATIVE ANALYSIS (National)**

Upon completion of the course, the students will be able to

1. Recognize the basic practical skills for the analysis of inorganic compounds
2. Inculcate the principle of qualitative analysis and eliminate the interfering radical.
3. Develop skill in identifying the simple salt containing one cation and anion.

## SEMESTER-V

**Subject code: 17AKP5**

**Course Name: INORGANIC, PHYSICAL AND MEDICINAL CHEMISTRY (Global)**

Upon completion of the course, the students will be able to

1. Apply the fundamental principles of chemical periodicity
2. Learn and analyse the bonding characteristics in compounds
3. Analyse the properties of different states of colloidal system
4. Discuss catalytic cracking of petroleum and reforming of petrol
5. Outline the procedure for synthesis of biodiesel
6. Know the various pharmaceutical drugs, their application and synthesis

## SEMESTER- VI

**Subject code: 17AKP6**

**Course Name: ANALYTICAL AND INORGANIC CHEMISTRY (Global)**

Upon completion of the course, the students will be able to

1. Apply analytical techniques in quantitative measurements
2. Appreciate the basic concepts of acid - base reactivity.
3. Classify the various metallurgical operations.
4. Give an extended knowledge about chromatographic techniques
5. Basic knowledge of nuclear structure, stable and unstable atomic nuclei, nuclear reactions and different modes of radioactive decay and also methods for measurements of radioactivity.
6. Develop skills in handling and measurement of radioactive material

**Subject Code: 17AKP6P**

**Course Name: VOLUMETRIC ANALYSIS (National)**

Upon completion of the course, the students will be able to

1. Perform double titrations for simple acid –base and redox reactions skillfully.
2. Identify different types of errors in quantitative analysis.
3. Calculate titration errors for method evaluation, and perform statistical evaluation of results from classical and instrumental chemical experiments and analysis.
4. Make scientific reports from chemical experiments and present the results in a transparent manner.