

DEPARTMENT OF CHEMISTRY

Programme Outcomes

PO1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.

PO2: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.

PO3: Critical thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO4: Problem solving: Capacity to extrapolate from what one has learned and applies their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

PO5: Analytical reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PO6: Research-related skills: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.

PO7: Cooperation/Teamwork: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

PO8: Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO9: Reflective thinking: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.

PO10: Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO11: Self-directed learning: Ability to work independently, identify appropriate resources

required for a project, and manage a project through to completion.

PO12: Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO13: Moral and ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.

PO14: Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.

PO15: Lifelong learning: Ability to acquire knowledge and skills, including learning how to learn, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

Programme Specific Outcomes:

On successful completion of Bachelor of Chemistry programme, the student should be able to:

PSO1: Disciplinary Knowledge: Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory.

PSO2: Critical Thinking: Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions, and communicate effectively.

PSO3: Problem Solving: Employ theoretical concepts and critical reasoning ability with physical, mathematical, and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities.

PSO4: Analytical & Scientific Reasoning: Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models.

PSO5: Research related skills: Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects.

PSO6: Self-directed & Lifelong Learning: Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field.

Title of the Course: GENERAL CHEMISTRY-I

Objectives of the course

The course aims at giving an overall view of the

- various atomic models and atomic structure
- wave particle duality of matter
- periodic table, periodicity in properties and its application in explaining the chemical behaviour
- nature of chemical bonding, and
- fundamental concepts of organic chemistry

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.
- **CO2:** classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents.
- **CO3:** apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx , Δp electro negativity, percentage ionic character and bond order.
- **CO4:** evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects
- **CO5:** construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms.

Title of the Course: QUANTITATIVE INORGANIC ESTIMATIONS (TITRIMETRY) AND INORGANIC PREPARATIONS

Objectives of the course

This course aims at providing knowledge on

- laboratory safety
- handling glass wares
- Quantitative estimation
- preparation of inorganic compounds

Course Learning Outcomes (for Mapping with POs and PSOs)

On successful completion of the course the students should be able to

- **CO1:** explain the basic principles involved in titrimetric analysis and inorganic preparations.
- **CO2:** compare the methodologies of different titrimetric analysis.
- **CO3:** calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.
- **CO4:** assess the yield of different inorganic preparations and identify the end point of various titrations.

Title of the Course: FOOD CHEMISTRY (SEC-1)

Objectives of the course

This course aims at giving an overall view of the

- Types of food
- Food adulteration and poisons
- Food additives and preservation

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO 1:** learn about Food adulteration - contamination of Wheat, Rice, Milk, Butter.
- **CO 2:** get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion
- **CO 3:** get an exposure on food additives, artificial sweeteners, Saccharin, Cyclamate and Aspartate in the food industries.
- **CO 4:** acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.
- **CO 5:** study about fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats –MUFA and PUFA

Title of the Course: ROLE OF CHEMISTRY IN DAILY LIFE

Objectives of the course

This course aims at providing an overall view of the

- importance of Chemistry in everyday life
- chemistry of building materials and food
- chemistry of Drugs and pharmaceuticals

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** learn about the chemicals used in everyday life as well as air pollution and water pollution.
- **CO2:** get knowledge on building materials cement, ceramics, glass and plastics, polythene, PVC, bakelite, polyesters,
- **CO3:** acquire information about Food and Nutrition. Carbohydrates, Proteins, Fats Also have an awareness about Cosmetics Tooth pastes, face powder, soaps and detergents.
- **CO4:** discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuel classification solid, liquid and gaseous; nuclear fuel - examples and uses
- **CO5:** have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications.

Title of the Course: FOUNDATION COURSE IN CHEMISTRY (Foundation Course)

Objectives of the course

The Course aims to make the students to

1. Understand the lab safety measures
2. Outline the basic concepts of organic chemistry
3. Describe the importance of periodic table
4. Explain the fundamentals of physical properties
5. Understand the importance of redox chemistry

Skills acquired from this course: Knowledge, Problem Solving, Analytical ability, Professional Competency, professional Communication and Transferable skills.

Title of the Course: GENERAL CHEMISTRY – II (Core III)

Objectives of the course

This course aims at providing an overall view of the

- chemistry of acids, bases and ionic equilibrium
- properties of s and p-block elements
- chemistry of hydrocarbons
- applications of acids and bases
- compounds of main block elements and hydrocarbons

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- CO1:** explain the concept of acids, bases and ionic equilibria; periodic properties of s and p-block elements, preparation and properties of aliphatic and aromatic hydrocarbons
- CO2:** discuss the periodic properties of s and p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids
- CO3:** classify hydrocarbons, types of reactions, acids and bases, examine the properties and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons
- CO4:** explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements
- CO5:** assess the application of hard and soft acids indicators, buffers, compounds of s and p-block elements and hydrocarbons

Title of the Course: QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS (Core IV)

Objectives of the course

This course aims at providing knowledge on

- laboratory safety
- handling glass wares
- analysis of organic compounds
- preparation of organic compounds

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** observe the physical state, odour, colour and solubility of the given organic compound.
- **CO2:** identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.
- **CO3:** compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind it.
- **CO4:** exhibit a solid derivative with respect to the identified functional group.

Title of the Course: DAIRY CHEMISTRY (SEC-2)
Objectives of the course

This course aims at providing an overall view of the

- chemistry of milk and milk products
- processing of milk
- preservation and formation of milk products.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO 1:** understand about general composition of milk – constituents and its physical properties.
- **CO 2:** acquire knowledge about pasteurization of Milk and various types of pasteurization - Bottle, Batch and HTST Ultra High Temperature Pasteurization.
- **CO 3:** learn about Cream and Butter their composition and how to estimate fat in cream and Ghee
- **CO 4:** explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.
- **CO 5:** have an idea about how to make milk powder and its drying process - types of drying process

Title of the Course: COSMETICS AND PERSONAL CARE PRODUCTS (SEC-3)

Objectives of the course

This course aims at familiarizing the students with

- formulations of various types of cosmetics and their significance
- hair, skin and dental care
- makeup preparations and personal grooming

Course Learning Outcomes (for Mapping with POs and

PSOs)

On completion of the course the students should be able to

CO1: know about the composition of various cosmetic products

CO2 understand chemical aspects and applications of hair care and dental care and skin care products.

CO3 understand chemical aspects and applications of perfumes and skin care products.

CO4 to understand the methods of beauty treatments their advantages and disadvantage

CO5 understand the hazards of cosmetic products.

Title of the Course: GENERAL CHEMISTRY – III (Core V)

Objectives of the course

This course aims to provide a comprehensive knowledge on

- the physical properties of gases, liquids, solids and X-ray diffraction of solids.
- fundamentals of nuclear chemistry and nuclear waste management.
- applications of nuclear energy
- basic chemistry of halo - organic compounds, phenol and other aromatic alcohols.
- preparation and properties of phenols and alcohols.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** explain the kinetic properties of gases by using mathematical concepts.
- **CO2:** describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determination.
- **CO3:** investigate the radioactivity, nuclear energy and its production, also the nuclear waste management.
- **CO4:** write the nomenclature, physical & chemical properties and basic mechanisms of haloorganic compounds and alcohols.
- **CO5:** investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.

Title of the Course: QUALITATIVE INORGANIC ANALYSIS (Core VI)

Objectives of the course

- To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.

Course Outcomes

On successful completion of the course the students should be able to

CO 1: acquire knowledge on the systematic analysis of Mixture of salts.

CO 2: identify the cations and anions in the unknown substance.

CO 3: identify the cations and anions in the soil and water and to test the quality of water.

CO4: assess the role of common ion effect and solubility product

Title of the Course: ENTREPRENEURIAL SKILLS IN CHEMISTRY (SEC-4)

Objectives of the course

The course aims at providing training to

- develop entrepreneur skills in students
- to provide hands on experience to prepare and develop products
- develop start ups

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO 1:** identify adulterated food items by doing simple chemical tests.
- **CO 2:** prepare cleaning products and become entrepreneurs
- **CO 3:** educate others about adulteration and motivate them to become entrepreneurs

Title of the Course: PESTICIDE CHEMISTRY (SEC-5)

Objectives of the course

This course aims at providing the students

- knowledge about the various types of pesticides and their toxicity.
- to understand the accumulation of pesticides in the form of residues and its analysis.
- knowledge on choice of alternate and eco-friendly pesticides.

Title of the Course: GENERAL CHEMISTRY-IV (Core VII)

Objectives of the course

This course aims to provide a comprehensive knowledge on

- thermodynamic concepts on chemical processes and applied aspects.
- thermo chemical calculations
- transition elements with reference to periodic properties and group study of transition metals.
- the organic chemistry of ethers, aldehydes and ketones
- the organic chemistry of carboxylic acids

Title of the Course: PHYSICAL CHEMISTRY PRACTICAL – I (Core VIII)

Objectives of the course

The course aims at providing an understanding of

- the laboratory experiments in order to understand the concepts of physical changes in chemistry
- the rates of chemical reactions
- colligative properties and adsorption isotherm

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** describe the principles and methodology for the practical work
- **CO2:** explain the procedure, data and methodology for the practical work.
- **CO3:** apply the principles of electrochemistry, kinetics for carrying out the practical work.
- **CO4:** demonstrate laboratory skills for safe handling of the equipment and chemicals.

Title of the Course: INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS (SEC-6)

Objectives of the course

The course aims at providing an overall view of the

- operation and troubleshooting of chemical instruments
- fundamentals of analytical techniques and its application in the characterization of compounds
- theory of chromatographic separation and
- theory of thermo / electro analytical techniques
- stoichiometry and the related concentration terms

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption
- spectrometry
- **CO2:** explain theory, instrumentation and application of UV visible and Infrared spectroscopy.
- **CO3:** able to discuss instrumentation, theory and applications of thermal and electrochemical techniques
- **CO4:** explain the use of chromatographic techniques in the separation and identification of mixtures
- **CO5:** explain preparation of solutions, stoichiometric calculations

Title of the Course: FORENSIC SCIENCE

Objectives of the course

This course aims at giving an overall view of

- crime detection through analytical instruments
- forgery and its detection
- medical aspects involved

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO 1:** learn about the Poisons - types and classification of poisons in the living and the dead organisms and also get information about Postmortem.
- **CO 2:** get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal detector devices and other security measures for VVIP - composition of bullets and detecting powder burns
- **CO 3:** detect the forgery documents, different types of forged signatures
- **CO4:** have an idea about how to track and trace using police dogs, foot prints identification and gain the knowledge in analyzing biological substances - blood, semen, saliva, urine and hair - DNA Finger printing for tissue identification in dismembered bodies
- **CO 5:** get the awareness on Aids - causes and prevention and also have an exposure on handling fire explodes.

Title of the Course: **ORGANIC CHEMISTRY – I (CORE IX)**

Objectives of the course

This course aims to provide an understanding of

- stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane
- preparation and properties of aromatic and aliphatic nitro compounds and amines
- preparation of different dyes, food colour and additives
- preparation and properties of five membered heterocycles like pyrrole, furan and thiophene
- preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- CO1:** assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane.
- CO2:** explain preparation and properties of aromatic and aliphatic nitro compounds and amines
- CO3:** explain colour and constitution of dyes and food additives
- CO4:** discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene
- CO5:** discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline

Title of the Course: INORGANIC CHEMISTRY – I (Core X)

Objectives of the course

The course aims to provide knowledge on

- nomenclature, isomerism and theory of coordination compounds, and chelate complexes
- crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect
- preparation and properties of metal carbonyls
- Lanthanoids and actinoids
- preparation and properties of inorganic polymer

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** explain isomerism, Werner's Theory and stability of chelate complexes
- **CO2:** discuss crystal field theory, magnetic properties and spectral properties of complexes.
- **CO3:** explain preparation and properties of metal carbonyls
- **CO4:** give a comparative account of the characteristics of lanthanoids and actinoids
- **CO5:** explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous

Title of the Course: PHYSICAL CHEMISTRY – I (Core XI)

Objectives of the course

The course aims at providing an overall view of

- Gibbs free energy, Helmholtz free energy, Ellingham's diagram and partial molar properties
- chemical kinetics and different types of chemical reactions
- adsorption, homogeneous and heterogeneous catalysis
- colloids and macromolecules
- photochemistry, fluorescence and phosphorescence

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellingham's
- **CO2:** apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.
- **CO3:** compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogeneous and heterogeneous catalysis.
- **CO4:** demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules.
- **CO5:** utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.

Title of the Course: BIOCHEMISTRY (EC-5)

Objectives of the course

The course aims at providing knowledge on

- relationship between biochemistry and medicine, composition of blood
- structure and properties of amino acids, peptides, enzymes, vitamins and proteins
- biological functions of proteins, enzymes, vitamins and hormones
- biochemistry of nucleic acids and lipids
- metabolism of lipids

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** explain molecular logic of living organisms, composition of blood and blood coagulation
- **CO2:** explain synthesis and properties of amino acids, determination of structure of peptides and proteins
- **CO3:** explain factors influencing enzyme activity and vitamins as coenzymes
- **CO4:** explain RNA and DNA structure and functions
- **CO5:** explain biological significance of simple and compound lipids

Title of the Course: INDUSTRIAL CHEMISTRY (EC-6)

Objectives of the course

This course is designed to provide knowledge on

- classifications and characteristics of fuels
- preparation of cosmetics
- manufacture of sugar, paper, cement and leather and food processing
- applications of abrasives, lubricants and other industrial products
- intellectual property rights

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** summarize the properties of fuels which include petroleum, water gas, natural gas and propellants
- **CO2:** evaluate cosmetic products, soaps, detergents.
- **CO3:** explain manufacture of sugar, food spoilages and food additives
- **CO4:** explain properties of abrasives, manufacture of leather and paper
- **CO5:** explain properties and manufacture of lubricants and cement, and intellectual property Rights

Title of the Course: PHYSICAL CHEMISTRY PRACTICAL – II (Core XIII)

Objectives of the course

This course aims at providing

- basic principles of physical chemistry experiments
- hands on experience in carrying out the experiments

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** Describe the principles and methodology for the practical work.
- **CO2:** Explain the procedure, data and methodology for the practical work
- **CO3:** Apply the principles of phase rule and electrochemistry for carrying out the practical work
- **CO4:** Demonstrate laboratory skills for safe handling of the equipment and chemicals

Title of the Course: ORGANIC CHEMISTRY – II (Core XIV)

Objectives of the course

This course aims at providing knowledge on

- classification, isolation and discussing the properties of alkaloids and terpenes
- preparation and properties of saccharides
- biomolecules
- different molecular rearrangement
- preparation and properties of organometallic compounds

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** explain isolation and properties of alkaloids and terpenes
- **CO2:** explain preparation and reactions of mono and disaccharides
- **CO3:** classify biomolecules and natural products based on their structure, properties, reactions and uses.
- **CO4:** explain molecular rearrangements like benzidine, Hoffmann etc.,
- **CO5:** preparation and properties of organolithium compounds

Title of the Course: INORGANIC CHEMISTRY – II (Core XV)

Objectives of the course

The course aims to provide knowledge on

- tracer elements and their role in the biological system.
- iron transport and storage
- metallo enzymes, oxygen transport.
- silicates and their applications
- industrial applications of refractories, alloys, paints and pigments

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** ability to explain the importance of tracer elements on biological system.
- **CO2:** explain the metal ion transport, Bohr effect, Na, K, Ca pump.
- **CO3:** explain the function of Vitamin B₁₂, Zn-Cu enzyme, ferredoxin, cluster enzymes.
- **CO4:** classification and structure of silicates.
- **CO5:** explain the manufacture of refractories, explosives, paints and pigments

Title of the Course: PHYSICAL CHEMISTRY- II (Core – XVI)

Objectives of the course

The course aims at providing an overall view of the

- phase diagram of one and two component systems
- chemical equilibrium,
- separation techniques for binary liquid mixtures.
- electrical conductance and transport number.
- galvanic cells, EMF and significance of electrochemical series.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** construct the phase diagram for one component and two component systems, explain the properties of freezing mixture, component with congruent melting points and solid solutions.
- **CO2:** apply the concepts of chemical equilibrium in dissociation of PCl₅, N₂O₄ and formation of HI, NH₃, SO₃ and decomposition of calcium carbonate. Demonstrate important principles such as Le Chatelier principle, van't Hoff reaction isotherm and Clausius-Clayperon equation.
- **CO3:** Identify an appropriate distillation method for the separation of binary liquid mixtures such as azeotropic mixtures, partially miscible mixtures and immiscible liquids.
- **CO4:** Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance.
- **CO5:** Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations.

Title of the Course: GRAVIMETRIC ESTIMATION PRACTICAL (Core XVII)

Objectives of the course

This course aims at providing

- basic principles of an analytical chemistry experiments
- hands on experience in carrying out the experiments

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** Describe the principles and methodology for the practical work. **CO2:** Explain the procedure, data and methodology for the practical work
- **CO3:** Apply the principles for carrying out the practical work
- **CO4:** Demonstrate laboratory skills for safe handling of the equipment and chemicals

Title of the Course: FUNDAMENTALS OF SPECTROSCOPY

Objectives of the course

This course is designed to provide knowledge on

- electrical and magnetic properties of organic and inorganic compounds
- basic principles of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry
- instrumentation of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry
- applications of various spectral techniques in structural elucidation
- solving combined spectral problems

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain electrical and magnetic properties of materials and microwave spectroscopy

CO2: explain theory, instrumentation and applications of Infrared and Raman spectroscopy

CO3: apply selection rules to understand spectral transitions, explain Woodward – Fieser's rule for the calculation of wavelength maximum of conjugated dienes

CO4: explain theory, instrumentation and applications of NMR spectroscopy

CO5: explain theory, instrumentation and applications of Mass spectrometry

Title of the Course: NANO SCIENCE (EC-8)

Objectives of the course

This course aims at providing knowledge on

- introduction to nanoparticles/clusters and nanocomposites
- properties of nanomaterials
- characterization of nanomaterials by different methods
- synthesis of carbon nanotubes, graphene, quantum dots, self-assembled nanomaterials
- applications of nanomaterials as sensors

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** explain the general concepts and physical phenomena of relevance within the field of nanoscience.
- **CO2:** describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications.
- **CO3:** examine the structure, properties, applicability and characterization of nanomaterials. **CO4:** analyze various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and graphene
- **CO5:** discuss applications of nanomaterials of sensors and in optics and electronics

Title of the Course: POLYMER SCIENCE (EC-8)

Objectives of the course

The course aims at providing an overall view of

- classification of polymers, preparation of polymers
- kinetics of polymerization and characterization of polymers
- analytical techniques used to characterize polymers
- reactions of polymers
- speciality polymers like PVC, PMMA

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** explain classification of polymers, elastomers, fibres and liquid resins
- **CO2:** explain addition and condensation polymerization, mechanical properties of polymers
- **CO3:** determine the molecular weight of polymers, and explain the thermal properties of polymers
- **CO4:** explain reactions of polymers and polymer processing
- **CO5:** discuss speciality polymers like PVC, PMMA, rubbers, biodegradable polymers

Title of the Course: PHARMACEUTICAL CHEMISTRY (EC-8)

Objectives of the course

The course aims at providing an overall view of

- drugs design and drug metabolism
- important Indian medicinal plants, common diseases and antibiotics
- drugs for major diseases like cancer, diabetes and AIDS
- analgesics and antipyretic agents
- significance of clinical tests

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** Define the pharmaceutical terminologies; describe the principles in pharmacological activity, drug development, clinical chemistry, hematology, therapeutic drugs and treatment of diseases; list the types of IPR and trademarks.
- **CO2:** Discuss the development of drugs, structural activity, disease types, physio-chemical properties of therapeutic agents, significance of medicinal plants, clinical tests and factors for patentability.
- **CO3:** Apply the principles involved in structural activity and drug designing, functions of haematological agents; estimation of clinical parameters and therapeutic application of drugs for major diseases.
- **CO4:** explain classification of analgesics and anesthetics, and physiological functions of plasma proteins
- **CO5:** explain the significance of clinical tests like blood urea, serum proteins and coronary risk index

GENERIC ELECTIVE (ALLIED)

Title of the Course: CHEMISTRY FOR PHYSICAL SCIENCES - I (FOR MATHEMATICS, PHYSICS & GEOLOGY STUDENTS) (GE-1A)

Objectives of the course

This course aims to provide knowledge on the

- basics of atomic orbitals, chemical bonds, hybridization
- concepts of thermodynamics and its applications.
- concepts of nuclear chemistry
- importance of chemical industries
- Qualitative and analytical methods

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- CO 1: gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.
- CO 2: evaluate the efficiencies and uses of various fuels and fertilizers
- CO 3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
- CO 4: apply various thermodynamic principles, systems and phase rule.
- CO 5: explain various methods to identify an appropriate method for the separation of chemical components

Title of the Course: CHEMISTRY FOR PHYSICAL SCIENCES - II (FOR MATHEMATICS, PHYSICS & GEOLOGY STUDENTS) (GE-2A)

Objectives of the course

This course aims at providing knowledge on the

- Co-ordination Chemistry and Water Technology
- Carbohydrates and Amino acids
- basics and applications of electrochemistry
- basics and applications of kinetics and catalysis
- Various photochemical phenomenon

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO 1:** write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology
- **CO 2:** explain the preparation and property of carbohydrate, amino acids and nucleic acids.
- **CO 3:** apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells. **CO 4:** identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst. **CO 5:** outline the various type of photochemical process.

Title of the Course: CHEMISTRY FOR BIOLOGICAL SCIENCES - I (FOR BOTANY, BIOCHEMISTRY AND ZOOLOGY STUDENTS) (GE-1B)

Objectives of the course

This course aims at providing knowledge on

- basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
- nuclear chemistry and industrial chemistry
- importance of speciality drugs and
- separation and purification techniques.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO 1:** state the theories of chemical bonding, nuclear reactions and its applications.
- **CO 2:** evaluate the efficiencies and uses of various fuels and fertilizers.
- **CO 3:** explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
- **CO 4:** demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.
- **CO 5:** analyse various methods to identify an appropriate method for the separation of chemical components.

Title of the Course: CHEMISTRY FOR BIOLOGICAL SCIENCES - II (FOR BOTANY, BIOCHEMISTRY AND ZOOLOGY STUDENTS) (GE-2B)

Objectives of the course

This course aims to provide knowledge on

- nomenclature of coordination compounds and carbohydrates.
- Amino Acids and Essential elements of biosystem
- understand the concepts of kinetics and catalysis
- provide fundamentals of electrochemistry and photochemistry

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO 1:** write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.
- **CO 2:** explain the preparation and property of carbohydrate.
- **CO 3:** enlighten the biological role of transition metals, amino acids and nucleic acids.
- **CO 4:** apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.
- **CO 5:** outline the various type of photochemical process.

Title of the Course: CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES – I (For Mathematics, Physics, Geology, Botany, Biochemistry and Zoology)

(I Year / I Semester (or) II Year / III Semester) (GE -3)

Objectives of the course

This course aims to provide knowledge on the

- basics of preparation of solutions.
- principles and practical experience of volumetric analysis

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette.

CO 2: design, carry out, record and interpret the results of volumetric titration.

CO 3: apply their skill in the analysis of water/hardness.

CO 4: analyze the chemical constituents in allied chemical products.

Title of the Course: CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES – II (For Mathematics, Physics, Geology, Botany, Biochemistry and Zoology)

(I Year / II Semester (or) II Year / IV Semester) (GE-4)

Objectives of the course

This course aims to provide knowledge on

- identification of organic functional groups
- different types of organic compounds with respect to their properties.
- determination of elements in organic compounds.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette. CO 2: design, carry out, record and interpret the results of volumetric titration.
- CO 3: apply their skill in the analysis of water/hardness.
- CO4: analyze the chemical constituents in allied chemical products