CHEMISTRY
## LIST OF COURSES

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<th>Sub Code</th>
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<td>14</td>
<td>18CH3004</td>
<td>Polymer Chemistry</td>
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### Course Objectives:
1. To understand the basic concepts in chemistry
2. To have knowledge on the applications of chemistry
3. To apply chemistry principles in engineering and technology

### Course Outcomes:
The student will be able to
1. To study about the basics of atomic and molecular structure
2. To know about the spectroscopic techniques and its applications
3. To know about the periodic properties
4. To understand the concepts of intermolecular forces
5. To study the concept of free energy and chemical equilibrium
6. To understand the basics of organic chemistry

#### Module 1: Chemical Bonding (9L + 3T)
Types of bonding – Ionic, Covalent, Coordinate bond, Vanderwaals forces, Hydrogen bond, Metallic bond
VB theory – Hybridization MO theory, bond order-Homonuclear and Hetronuclear diatomic molecules

#### Module 2: Spectroscopic techniques and applications (9L + 3T)
Electromagnetic radiation, relation between wave length, wave number, frequency and energy- General features of absorption photometer – Principles and applications of IR, Raman, UV-Visible, NMR spectroscopy - Flame photometer – Introduction to Atomic Absorption Spectroscopy – Types of Chromatography – Applications

#### Module 3: Fuels and combustion (6L +2T)
Fuels-classification, calorific value, desired properties of good coal - Dulong’s formula - Proximate analysis of coal and its significance- Ultimate analysis of coal and its significance - Knocking-octane number, cetane number, antiknocking characteristics of petrol - Flue Gas Analysis – Orsat Method - Biomass - Biogas-production, biofuels- bio-diesel and bio-ethanol

#### Module 4: Energy sources and storage devices (9L + 3T)
battery- Electrochemical sensors -Relationship between electrical energy and heat energy – Gibbs Helmholtz equation, Photovoltaics

**Module 5: Water Chemistry (6L + 2T)**

**Module 6: Reaction Mechanism (6L + 2T)**
Introduction- Homolytic and heterolytic bond fission- Classification of reactions- Types of Attacking Reagents- Inductive effect- Electromeric effect- Resonance effect- Hyperconjugation- Effect of Hybridization- types of Addition reaction- Types of Substitution reaction- Types of Elimination reaction-Mechanism of elimination reaction- Mechanism of Nucleophilic substitution reaction- Steric hindrance

**Text Books:**

**Reference Books:**
3. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

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<tr>
<th>18CH1002</th>
<th>APPLIED CHEMISTRY LABORATORY</th>
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**Course Objectives:**
1. To understand the basic concepts in chemistry
2. To have knowledge on the applications of chemistry
3. To apply chemistry principles in engineering and Technology

**Course Outcomes:**
The students will be able to:
1. Understand the kinetics of a chemical reaction
2. Analyse the water quality
3. Apply the electrochemistry principles
4. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials
5. Synthesize a small drug molecule
6. Analyse a salt sample

**List of Experiments**
Choice of 10-12 experiments from the following:
1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

Textbooks:

Course Objectives:
1. To make the student conversant with the fundamentals of chemical bonding and nanotechnology
2. To encourage students to develop curiosity towards fuels, energy resources and storage devices
3. To acquire knowledge about polymers and surface chemistry

Course Outcomes:
The Student will be able to
1. formulate electronic structures and correlate its properties
2. realize the potential applications of polymers
3. relate the unique properties of nanomaterials and explain methods of fabricating nanostructures
4. analyze the combustion process of common fuels
5. learn the various energy storage systems and conversion devices
6. describe the techniques involved in adsorption and colloids

Module 1: Chemical Bonding (9L + 3T)
Types of bonding – Ionic, Covalent, Coordinate bond, Vanderwaals forces, Hydrogen bond, Metallic bond VB theory – Hybridization MO theory, bond order- Homonuclear and Hetronuclear diatomic molecules

Module 2: Polymers (9L + 3T)

Module 3: Nanomaterials and Fabrication (6L +2T)
Nanomaterials –Classification - Top down and Bottom up Approaches - High energy Ball milling – microfabrication – CVD, sol-gel – Nanomaterials - Fullerenes – Self assembled monolayers –preparation and application - characterization of nanomaterials – Introduction to XRD, SEM -Applications of nanotechnology
Module 4: Fuels and combustion (6L +2T)
Fuels-classification, calorific value, desired properties of good coal - Dulong’s formula -Proximate analysis of coal and its significance -Ultimate analysis of coal and its significance -Knocking-octane number, cetane number, antiknocking characteristics of petrol -Flue Gas Analysis – Orsat Method - Biomass - Biogas-production, biofuels- bio-diesel and bio-ethanol

Module 5: Energy sources and storage devices (9L + 3T)
Redox reactions – electrode potential - Nernst Equation - Electrochemical series and significance - Electrochemical cell, reference electrode - Batteries – dry cell -Lead acid battery - Fuel cell - Solar battery- Electrochemical sensors -Relationship between electrical energy and heat energy – Gibbs Helmholtz equation, Photovoltaics

Module 6: Surface chemistry (6L +2T)
Adsorption- Classification, uses - Langmuir’s theory of adsorption - Colloids – types, applications - Colloids – Preparation - Characteristics of Colloids, Micelles

Text Books:

Reference Books:
2. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

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<th>18CH1004</th>
<th>CHEMISTRY FOR COMPUTER SCIENCE AND ENGINEERING</th>
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Course objectives
1. To make the student conversant with the fundamentals of chemical bonding and nanotechnology
2. To encourage students to develop curiosity towards energy resources and storage devices
3. To acquire knowledge about solid state and liquid crystals

Course outcome
The Students will be able to
1. formulate electronic structures and correlate its properties
2. realize the potential applications of polymers
3. relate the unique properties of nanomaterials and explain methods of fabricating nanostructures
4. know about various energy storage devices
5. learn the importance of solid state chemistry
6. realize the applications of the liquid crystals in various domains

Module 1: Chemical Bonding (9L + 3T)
Types of bonding – Ionic, Covalent, Coordinate bond, Vanderwaals forces, Hydrogen bond, Metallic bond VB theory – Hybridization MO theory, bond order- Homonuclear and Hetronuclear diatomic molecules

Module 2: Polymers (9L + 3T)

Module 3: Nanomaterials and Fabrication (6L +2T) Nanomaterials –Classification - Top down and Bottom up Approaches - High energy Ball milling – microfabrication – CVD, sol-gel – Nanomaterials -
Fullerens – Self assembled monolayers –preparation and application - characterization of nanomaterials
- Introduction to XRD, SEM -Applications of nanotechnology

**Module 4: Energy sources and storage devices (9L + 3T)**
Redox reactions – electrode potential - Nernst Equation - Electrochemical series and significance - Electrochemical cell, reference electrode - Batteries – dry cell -Lead acid battery - Fuel cell - Solar battery- Electrochemical sensors -Relationship between electrical energy and heat energy – Gibbs Helmholtz equation, Photovoltaics

**Module 5: Solid State (6L +2T)**
Crystal structure-Unit cell, radius ratio -Miller indices, crystal imperfections- Schottky and Frenkel defects - Band theory of solids-types of semi conductors- Intrinsic and Extrinsic semi conductors – Preparation of semiconductors - Super conductors

**Module 6: Liquid Crystals (6L +2T)**
Liquid crystals –classification, thermotropic and Lyotropic liquid crystals, structure of liquid crystal forming compounds, Chemical properties, Applications of liquid crystals

**Reference Books:**

**Text Books:**
2. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

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**Course objectives**
1. To make the student conversant with the fundamentals of chemical bonding and nanotechnology
2. To encourage students to develop curiosity towards water technology, corrosion and nanocomposites
3. To acquire knowledge about polymers, paints and concrete.

**Course outcomes**
The Student will be able to
1. formulate electronic structures and correlate its properties
2. realize the potential applications of polymers
3. relate the unique properties of nanomaterials and explain methods of fabricating nanostructures
4. analyze the components present in paints and concrete
5. learn the various factors in water quality and its technology
6. describe the process of corrosion and its prevention

**Module 1: Chemical Bonding (9L + 3T)**
Types of bonding – Ionic, Covalent, Coordinate bond, Vanderwaals forces, Hydrogen bond, Metallic bond VB theory – Hybridization MO theory, bond order- Homonuclear and Hetronuclear diatomic molecules

**Module 2: Polymers (9L + 3T)**
Module 3: Nanomaterials and Fabrication (6L +2T)
Nanomaterials – Classification - Top down and Bottom up Approaches - High energy Ball milling – microfabrication – CVD, sol-gel – Nanomaterials - Fullerenes – Self assembled monolayers – preparation and application – characterization of nanomaterials – Introduction to XRD, SEM - Applications of nanotechnology

Module 4: Water Chemistry (9L +3T)

Module 5: Paint and corrosion (6L + 2T)

Module 6: Cement and Concrete (6L +2T)

Text Books:

Reference Books:
2. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

Course objectives
1. To make the student conversant with the fundamentals of chemical bonding, polymers and Organic Chemistry.
2. To encourage students to understand the basis of nanotechnology.
3. To acquire knowledge about Instrumental methods of analysis.

Course outcomes
The Student will be able to
1. Formulate electronic structures and correlate its properties
2. Realize the potential applications of polymers
3. Relate the unique properties of nanomaterials and explain methods of fabricating nanostructures
4. Learn the structure of organic molecules.
5. Predict and understand the reactivity of organic reaction.
6. Apply the instrumental methods for various types of analysis.

Module 1: Chemical Bonding (9L + 3T)
Types of bonding – Ionic, Covalent, Coordinate bond, Vanderwaals forces, Hydrogen bond, Metallic bond VB theory – Hybridization MO theory, bond order- Homonuclear and Hetronuclear diatomic molecules
Module 2: Polymers (9L + 3T)

Module 3: Nanomaterials and Fabrication (6L +2T)
Nanomaterials –Classification - Top down and Bottom up Approaches - High energy Ball milling – microfabrication – CVD, sol-gel – Nanomaterials - Fullerenes – Self assembled monolayers –preparation and application - characterization of nanomaterials – Introduction to XRD, SEM -Applications of nanotechnology

Module 4: Stereochemistry (6L + 2T)
Stereoisomerism- Geometrical Isomerism- Optical Activity- Optical Isomerism, Diastereomers - Optical activity without Asymmetric carbons- E and Z system nomenclature- R and S system nomenclature- D,L system- Conformational isomerism of Butane.

Module 5: Reaction Mechanism (6L +2T)
Introduction- Homolytic and heterolytic bond fission- Classification of reactions- Types of Attacking Reagents- Inductive effect- Electromeric effect- Resonance effect- Hyperconjugation- Effect of Hybridization- types of Addition reaction- Types of Substitution reaction- Types of Elimination reaction- Mechanism of elimination reaction- Mechanism of Nucleophilic substitution reaction- Steric hindrance

Module 6: Instrumental Methods (9L +3T)
Electromagnetic radiation, relation between wave length, wave number, frequency and energy- General features of absorption photometer – Principles and applications of IR, Raman, UV-Visible, NMR spectroscopy - Flame photometer – Introduction to Atomic Absorption Spectroscopy –Types of Chromatography –Applications

Text Books:

Reference Books:
3. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

Course Objectives:
1. acquire the knowledge of environmental studies, it’s need & importance
2. know about problems related to various types of pollution
3. make the learners sensitive to the environment problems in every professional endeavor in which they participate

Course Outcomes:
The Student will be able to
1. Understand the natural environment and its relationships with human activities.
2. Acquire practical skills for solving pollution related problems
3. Design and evaluate strategies and apply green technologies
4. Identify the methods for sustainable development and for the remediation or restoration of degraded environments.
5. Integrate facts, concepts, and methods from multiple disciplines and apply to environmental and social problems.
6. Analyze the connectivity between the man made activities-Pollution-environmental issues-social problems-eco friendly solutions

Module 1: ENVIRONMENT AND NATURAL RESOURCES: (9L)
Environment - Definition, scope and importance, Renewable and Non-Renewable Resources – Natural resources and associated problems – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Energy resources: Growing energy needs, renewable and non-renewable energy sources, and use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Activity: Field study of local area to document environmental assets.


Module 4: ENVIRONMENTAL POLLUTION (9L)

Module 5: SOCIAL ISSUES AND ENVIRONMENTAL LEGISLATION (9L)

Module 6: HUMAN POPULATION AND THE ENVIRONMENT: (7L)

Text book

Reference Books

**18CH2002**

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Course Objectives:
1. To apply chemistry in technology
2. To acquire knowledge in energy and materials
3. To know about the green chemistry and modern analytical techniques

Course Outcomes:
1. To understand the basics of polymers
2. To know about surfactants, lubricants and corrosion
3. To have knowledge on nano materials
4. To know about the metal and alloys
5. To gain knowledge on modern analytical techniques
6. To know about the basic concepts in energy and green chemistry

Module 1: Polymers (9 lectures)
Classification, Tacticity - Tacticity and Functionality of Polymers - Types of Polymerization Addition, Condensation - Synthesis and properties of Bakelite, PVC, Nylon - Moulding Constituents of Plastics - Thermoplastics and Thermosetting - Vulcanization of Rubber - Applications of Polymers

Module 2: Surfactants and lubricants, corrosion (9 lectures)

Module 3: New materials / nano materials (9 lectures)

Module 4: Environmental and green chemistry (6 lectures)
Air and noise pollution. Optimum levels of pollution - Water pollution & Solid waste treatment - Significance and determination of COD and BOD - Greenhouse effect and global warming - E – Waste - radioactive pollution - Applications of green chemistry and green technology

Module 5: Energy Science (6 lectures)
battery- Electrochemical sensors -Relationship between electrical energy and heat energy – Gibbs Helmholtz equation, Photovoltaics

Module 6: Metal and alloys (6 lectures)
Phase rule and applications to one, two and multi-component systems - Iron-carbon phase diagram.
Types of alloys, carbon steel, alloy steel, alloys of Cu, Al, Pb – Applications of alloys

Text Books:

Reference Books:
1. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

18CH2003 POLYMER CHEMISTRY

Course objectives
1. To attain complete knowledge about polymers
2. To recognize the structure-property correlation
3. To understand the applications of polymers in various fields

Course outcome
The student will be able to
1. Analyse different mechanisms of polymer formation and use this information in the synthesis of different polymers
2. Evaluate the effect of factors such as polymer structure, molecular weight, branching and diluents on crystallinity
3. Interpret experimental data and determine parameters such as polymerization rates and copolymer composition
4. Distinguish between enthalpic and entropic contributions to polymerisation/crystallization
5. Distinguish between absolute and relative methods for molecular weight determination
6. Assess the effect of synthetic polymers on the environment

Module 1 Introduction
Introduction - definition, origin and nomenclature; Classification and types of polymers (Natural & synthetic; addition & condensation and thermoplastics & thermosetting); Molecular Weight (MW) of polymers- Number and weight averaged MW; Natural polymers, and Biodegradable polymers (PHB)

Module 11 Chemistry of Polymerisation
Step growth polymerization-reactivity of functional group, ester and amide formation; Condensation polymerization (Nylon 66); Free radical polymerization-reaction, mechanism; Ionic polymerization-cationic polymerization-steps, mechanism; Ionic polymerization- anionic polymerization-steps, mechanism; Ionic polymerization- ring opening polymerization-steps, mechanism; Copolymerization-types, graft, block, alternate, random, example; Composition, reactivity ratio

Module 11 Properties of Polymers
Polymer solution – process of dissolution; Thermodynamics of polymer; Flory-Huggins theory; Theta conditions-solubility parameter (Miscibility); Osmotic pressure-lower critical solution temperature; MW determination method (viscometry); Thermal behaviour of polymers – Melting (T_M) and Glass transition (T_g); Deformation behaviour of polymers; Colligative properties of polymer-osmotic pressure;

Module 1V Applications of Polymers
Lithography – principle and procedure; Photolithography; Electron beam lithography; X-ray lithography; Ion beam lithography; Conducting polymers-example-types-properties, applications; Photonic
applications, optical information storage; Polyester Fibres – mechanical property-crystallinity; Stress and strain behaviour; Carbon fibres and nanotubes – introduction and applications;

**Unit V Polymer Composites**
Introduction - Polymer blends; Polymer composites – characteristics and types; Introduction to Nano-composites; Clay, CNT and particle filled nanocomposites; Advantages and limitations of nanofillers; Surface treatment on nanofillers

**Textbooks:**

**Reference Books:**
2. NPTEL Polymer Chemistry Course, D. Dhara, IIT Kharagpur

<table>
<thead>
<tr>
<th>18CH2004</th>
<th>Experiments in Polymer Chemistry</th>
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**Course Objectives:**
1. Have a hands on experience on synthesis of different polymers
2. Analyze the properties of polymer
3. Learn different characterisation technique

**Course Outcomes:**
The Student will be able to
1. Understand importance of molecular weight of polymers
2. Measure molecular weight and osmotic pressure of polymers
3. Realize the significance of Colligative properties of polymers
4. Know the different synthetic routes of polymers
5. Recognize the importance of epoxy resin
6. Analyze the thermal properties of polymers

**List of experiments**
The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

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<th>18CH3001</th>
<th>Research Methodology and IPR</th>
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**Course Objectives:**
1. To make the student conversant with Chemical Abstracts for their Literature collections
2. To encourage students to develop curiosity towards commercial Chemistry softwares for their research
3. To acquire knowledge about chemical reaction set-up and its scientific relevance.

**Course Outcomes:**
The Student will be able to
1. formulate the chemical reaction design and set-ups
2. realize the potential applications of chemical softwares
3. relate the available informatics applications for the design of potential molecules
4. analyze the components of rating like impact factor, citation index

Chemistry
5. learn the procedure for IPR
6. describe a research problem using the available chemistry resources.

**Module 1: Chemical Literature Databases**: Chemical/Beilstein abstracts, CAS Number, DOI, Citation Index, Impact Factors, h-index, Scifinder/Reaxys design, Keyword Text Search, Sub-structure search Identification of Research Problems, Scopus and Web of Sciences.

**Module 2: Chemistry Softwares**: Structure Tools, Chemical drawings and Chiral representations, Chemsketch, BioRad, Chemoffice, Chemdraw, 3D representation, Energy Minimization process, Substructure identifications, Chemical Structures for manuscript (ACS, RSC, Elsevier), Chemical compounds and Suppliers identification.

**Module 3: Chemical Reaction Design**: Karl-Fisher Titrations for moisture content, Dean Stork Reaction set-up, Soxhlet extraction set-up, Barr hydrogenation Apparatus, Concept of Rotary evaporator, Auto Titrator, Reaction monitoring- dry/wet reaction set-up, handling hygroscopic compounds. Low Temperature bath (freezing mixture). Anhydrous conditions.

**Module 4: Research Ethics and Technical writing**: Effective literature studies approaches, analysis – Plagiarism - Research ethics - Effective technical writing, how to write report, Paper - Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee


**Reference Books:**

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<td>Understand the properties of polymers</td>
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<td>Recognize the importance of wear and tear of materials in particular polymers</td>
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<td>Be aware of the applications of polymer and their composites in various fields</td>
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**Course outcome**
The student will be able to
1. Acquire basic knowledge about polymers
2. Recognize the polymer composites and their fabrication processes
3. Appreciate the fundamentals of tribology
4. Identify various types of friction and wear test modes
5. Correlate the friction and wear behaviour of polymers with various material as well as operating properties
6. Realize the influence of nanofillers on friction and wear properties of polymer nanocomposites

**Module 1. Introduction to Polymer**
Introduction to material – metal, polymer and ceramic; Polymers – functionality and tacticity; classification of polymers –force that exists between the polymer chain; structure-property relationships;
Thermal behaviour of polymers - Tg, Tm and their relationships; Elastic effect of polymers – Hooke, Newton, Maxwell and Voight models -.

**Module 2. Polymer Composites**
Polymer composites – Introduction; types of composites – particle filled, short and long fibre reinforced; laminates; filler-matrix interaction; Fabrication of polymer nano-composites - Compounding of plastics – additives added and their significance – moulding process – injection and compression moulding, lamination, hand lay-up and filament winding techniques; Characterisation – mechanical and thermal–.

**Module 3. Basic Concepts of Tribology**
Tribology – Basic concept and its economical importance; Introduction to friction, wear and lubrication; Factors influencing friction and wear of polymers; advantages of polymers over metal; Friction and Wear studies – abrasive, adhesive, erosive, fretting wear modes –; Various types of wear test rigs – Pin-on-disc, block-on-ring–.

**Module 4. Tribology of Polymer Composites**
Friction and Wear studies - polymer composites in different wear modes; Influence of operating parameters viz. load, speed, counter-face roughness.; correlation between material properties and wear behaviour; Worn surface analysis;-

**Module 5. Tribology of Polymer Nanocomposites**
Polymer nanocomposites – introduction; various types of nanofillers; advantages and limitations of nanofillers; surface treatment of nanofillers; effect of nanofillers on friction and wear behaviour of polymers; Worn surface analysis; applications of polymer nanocomposites – automotive and mechanical components;

**Reference Books:**

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<th>18CH3003</th>
<th>Laboratory Chemistry for the Daily Life</th>
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**Course Objectives**
1. To make the student familiar with ayurvedic products in daily life
2. To encourage students to develop curiosity towards the preparation of cosmetics
3. To acquire knowledge about soaps and detergents

**Course Outcomes**
The student will be able to
1. formulate Ayurveda tooth paste, mouth was and hair hail
2. prepare instant head ache relief balm and dish wash powders
3. lip balm from vegetable extracts
4. Preparation of phenyl and analyzing
5. learn the procedures for preparing natural Insect repellant spray/ointment
6. learn the techniques involved in preparation homemade lotion and cream

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

References:
1. Surfactants, Disinfectants, Cleaners, Toiletries, Personal Care Products Manufacturing and Formulations by NPCS Board of Consultants & Engineers, NIIR Project Consultancy Services, 2016

<table>
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<tr>
<th>18CH3004</th>
<th>POLYMER CHEMISTRY</th>
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Course objectives
- To attain complete knowledge about polymers
- To know the structure-property correlation
- To understand the applications of polymers in various fields

Course outcome
- Understand the overview of various properties of polymers
- Analyse different mechanisms of polymer formation and use this information in the synthesis of different polymers
- Interpret experimental data and determine parameters such as polymerization rates and copolymer composition
- Evaluate the effect of factors such as polymer structure, molecular weight, branching and diluents on their properties
- Discriminate the different types of industrial polymerisation process and their fabrication techniques
- Know more about various types of novel polymeric nanocomposites

Module I. Basic concepts of polymers 6 hrs

Module II. Principles of polymerization 12 hrs

Module III. Polymer properties 7 hrs

Module IV. Polymerization processes and fabrication of plastics 8 hrs
Polymerization processes – bulk, solution, emulsion and suspension – industrially important polymers and their polymerization processes – poly styrene – nylon 6,6 – PET – Compounding of plastics –
additives added and their significance – moulding process – injection, compression and blow moulding, lamination, hand lay-up and filament winding techniques.

**Module V. Polymer Nanocomposites**

Polymer composites - introduction – filler-matrix interaction, fiber reinforced composites (FRP) – short, continuous fiber reinforced composites, laminates – Introduction to polymer nanocomposites – clay, graphene, CNT, particle filled – advantages and limitations of nano fillers – surface treatment on nano fillers – applications of polymer nanocomposites – automotive, packaging and mechanical components etc.

**Text Books:**


**Reference Books:**

### LIST OF COURSES

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#### 17CH1001 INSTRUMENTAL TECHNIQUES IN CHEMISTRY

**Credits:** 2:0:2

**Course Objectives:**

Enable the student to
- educate the principles of various types of titrations
- know the instrumentation techniques used in chemistry
- train the practical knowledge of the analytical techniques in chemistry
Course Outcomes:
The student will be able to
- understand the importance of accuracy in measurement of data
- utilize the quantitative techniques in chemistry
- understand the principles of spectroscopic techniques
- apply the principles of titration techniques
- apply the principles of electroanalytical techniques
- choose the appropriate separation technique

UNIT I: VOLUMETRIC AND GRAVIMETRIC ANALYSIS: Data Analysis – Accuracy and Precision - Classification of quantitative methods – Volumetric Analysis – Standardization – Buffer – Neutralization, Complexometric and Redox titrations -Titration – Gravimetry – Conditions of Precipitation - Instrumental Techniques


Practicals:
1. Estimation of sodium hydroxide.
2. Estimation of Fe$^{3+}$ ions.
3. Estimation of Total, Permanent and Temporary hardness by EDTA method.
5. Estimation of dissolved oxygen in water sample.
6. Estimation of Iodine Content in Iodized Common Salt
7. Estimation of Copper in Brass
8. Estimation of Calcium in Milk Powder
11. pH Measurements for Acid/Alkali Titration.
12. Estimation of iron in water sample by spectrophotometry.
13. Estimation of Potassium using Flame Photometry
14. Analysis by Thin Layer Chromatography
15. Separation of compounds by Column Chromatography
16. Gravimetric Estimation of Nickel

Reference Books:
17CH1002 APPLIED CHEMISTRY

Credits: 3:0:0

Course Objectives:
Enable the student to

- Learn the problems associated water treatment methods.
- Understand the concepts of thermodynamics and energy resources
- Classify the types of materials and their applications

Course Outcomes:
Students will be able to

- recognize hard water and softening methods
- understand chemical thermodynamics
- identify the types of batteries
- explain the problems associated with corrosion
- appraise the significances of polymers
- utilize the knowledge of advanced materials

Unit I - WATER TREATMENT:
- Hardness, Units and calculation of hardness
- Estimation of hardness by EDTA method
- Softening of water
- External conditioning
- Zeolite process
- Ion – Exchange process
- Scale and sludge sources and disadvantages
- Internal conditioning
- Calgon & Carbonate conditioning
- Boiler corrosion causes (DO, CO₂, acids) & removal methods
- Desalination – Reverse Osmosis
- Municipal water treatment

Unit II - THERMODYNAMICS:
- Thermodynamic Concepts
- System, surroundings, open, closed, Isolated system
- Mass, Energy, Internal energy & work
- Extensive property & Internal property
- Exothermic and Endothermic reaction, State function
- Thermodynamics process: Isothermal, Adiabatic, Isobaric, Isochoric
- Zeroth and first law of thermodynamics
- Enthalpy relation between pressure, volume and work
- ΔH & ΔU, Hess’s Law and its applications
- Heat and Heat capacity
- Relation between Cp&Cv for ideal gases
- Cyclic process – Carnot theorem
- Entropy
- Definition and entropy change in reversible and an irreversible process
- Spontaneity of a reaction (definition)
- Gibb’s free energy and standard Gibb’s free energy of systems
- Second law of thermodynamics
- Gibb’s – Helmholtz equation

Unit III - ELECTROCHMISTRY:
- Specific, Molar & Equivalent conductivities
- Redox reaction
- Electrode potential
- Measurement of electrode potential
- Nernst equation
- Electrochemical series and its importance
- Electrochemical cells
- Liquid Junction Potential
- Batteries – Primary cells
- Secondary cells (lead acid battery)
- H₂–O₂ fuel cells
- Electrochemical sensor
- Working principle and its applications

Unit IV - CORROSION & POLYMERS:
- Corrosion – Types
- Dry (Oxidation corrosion with mechanism)
- Wet Corrosions (Galvanic corrosion with mechanism)
- Factors influencing Corrosion and Control methods
- Polymers – Introduction, properties of polymers
- Applications of polymers in medicine
- Polymer blends & alloys
- Moulding constituents of plastics
- Fabrication – Injection & compression mouldings
- Biodegradable polymers
- Classification and its applications
- Biopolymers – definition and functions of Carbohydrates and Proteins

Unit V - ADVANCED MATERIALS:
- Nanomaterials - Introduction
- Types with examples
- particulate (metal/metal oxide), tubular/fibre (CNT/CNF), layered (Nanoclays, Graphene Oxide)
- Preparation of nanomaterials
- Top down (Ball milling, CVD) and Bottom up (Self-assembly, sol–gel)
- Applications
- Medicine & medical implants
- Next generation computer technology
- High definition
- Data & energy storage
- Fabric industry
- Automotive and aerospace
- Environment
- Electronics (satellites)
- Solar cells – photovoltaic cells – need, design, working and its limitations

Reference Books


17CH1003 APPLIED CHEMISTRY LAB

Credits: 0:0:2

Course Objectives:
Enable the student to
- Learn the methods to estimate the amount of substance present in a solution quantitatively.
- analyze the quality of water
- have a hands on experience on the electrochemical and spectrophotometric techniques

Course Outcomes:
Students will be able to
- recognize the effects of hardness of water in industrial applications and its estimation.
- know the merits and demerits of dissolved oxygen in water and their estimation.
- understand the principles of complexometric titrations.
- estimate water contamination using titrations.
- apply the principles of electrochemical techniques.
- understand the principles of spectrophotometry.

12 approved experiments will be notified at the beginning of the semester

17CH1004 ENVIRONMENTAL STUDIES

Credits: 3:0:0

Course Objectives:
Enable the student to
- acquire the knowledge of environmental studies, it’s need & importance
- know about problems related to various types of pollution
- make the learners sensitive to the environment problems in every professional endeavor in which they participate

Course Outcomes:
Students will be able to
- Understand the natural environment and its relationships with human activities.
- Acquire practical skills for solving pollution related problems
- Design and evaluate strategies and apply green technologies
- Identify the methods for sustainable development and for the remediation or restoration of degraded environments.
- Integrate facts, concepts, and methods from multiple disciplines and apply to environmental and social problems.
- Analyze the connectivity between the man made activities-Pollution-environmental issues-social problems-eco friendly solutions

Unit I: ENVIRONMENT AND NATURAL RESOURCES: Environment - Definition, scope and importance , Renewable and Non-Renewable Resources – Natural resources and associated problems – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Energy resources: Growing energy needs, renewable and non-renewable energy sources, and use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Activity: Field study of local area to document environmental assets.

preparation for Ecosystems / Biodiversity (OR) Documentation of available ecosystems/Biodiversity within Campus.


Reference Books:

17CH2001 – CHEMICAL BONDING AND CONCEPTS OF ACIDS AND BASES

Credits: 3:0:0

Course Objectives:
Enable the student to
- Learn the types of bonds and theories regarding bonding interactions
- Understand the concepts of acids and bases
- Learn about the allotropy of carbon

Course Outcomes:
Students will be able to
- recognize different types of bonds
- understand the theories of bond
- know the basics of bonding interactions
- explain the concepts acids and bases
- understand the theories of acids and bases
- acquire knowledge about carbon allotropes


UNIT III - General properties of metals in conductivities, Malleability, Luster -Bond lengths-Theories of bonding: free e -VB, Molecular bond theory-Conductors, insulators and semiconductors Super conductivity -And Alloys

2017 | Chemistry


Reference Books:

17CH2002 – ORGANIC REACTION INTERMEDIATES AND STEREOCHEMISTRY

Credits: 3:0:0

Course Objectives:
Enable the student to
- impart basic understanding about reaction intermediates
- illustrate the concepts of electronic effects
- highlight the importance of stereoisomerism and conformational analysis

Course Outcomes:
Students will be able to
- understand the structural basics of organic compounds.
- Know the various types of organic reactions and their properties.
- Recognize the importance of carbonyl and nitrogen containing compounds
- understand the concept of stereoisomerism.
- Name the compound based on CIP nomenclature.
- Apply the conformational analysis for the cyclic systems

Unit I - INTRODUCTION TO ORGANIC CHEMISTRY:
Classification of organic compounds – Functional groups – Nomenclature of Organic compounds – Nomenclature of heterocyclic compounds – Fission of bonds – Electrophiles and nucleophiles (Definition, Discussion on the conditions these are formed) – Carbocation and Carbanion, Free radicals, Arynes (Structure and reaction only; methods to identify these species are not required).

Unit II - ELECTRONIC EFFECTS AND TYPES OF REACTIONS:
Inductive effect and field effect – Electron delocalization and resonance, Rules of resonance – Steric inhibition of resonance and steric enhancement of resonance (with only one example for each) – Hyperconjugation – Tautomerism.

Unit III - ALIPHATIC AND AROMATIC CHEMISTRY:
Aliphatic carbonyl compounds (aldehydes and ketones) – Aliphatic nitrogen containing compounds – Aromatic aldehydes and ketones – Aromatic nitrogen containing compounds – Azines – Arenediazonium salts.

Unit IV - STEREOCHEMISTRY:
Stereoisomerism – Cis-trans isomerism (Definition and examples only) – E, Z nomenclature (Rules and examples only) – Optical isomerism – Cause of optical activity – Racemization – Resolution methods – Absolute configuration – R, S nomenclature – Cahn, Ingold, Prelog nomenclature.

Unit V - CONFORMATIONS:

Reference Books:

17CH2003 ATOMIC STRUCTURE, THERMODYNAMICS AND ELECTROCHEMISTRY

Credits: 3:0:0

Course Objectives:
Enable the student to
- understand the basics of Quantum Chemistry
- know the principles of chemical thermodynamics and electrochemistry
- apply the concept of Phase Rule

Course Outcomes:
Students will be able to
- recognize the importance of Quantum Chemistry
- know the importance of Thermodynamics
- understand the significance of Phase rule
- know the principles of electrochemistry
- classify the various types of electrochemical cells
- apply the proper method to prevent corrosion


Unit III – Thermodynamics: definition - First law of thermodynamics, relation between C_p and C_v, enthalpies of physical and chemical changes – second law of thermodynamics, entropy, Gibbs-Helmholtz equation – third law of thermodynamics and calculation of entropy

Free energy and entropy of mixing, partial molar quantities, Gibbs-Duhem equation – equilibrium constant, temperature dependence of equilibrium constant

Unit IV - Electrochemistry I: Kohlrausch law - equivalent conductance - molar conductance - Electrode potential – Measurement of electrode potential – Nernst equation for electrode potential – Electrochemical Series – Electrochemical cell or Voltaic cell – Concentration cell – Primary Cell– LeClanche cell - Secondary batteries – alkaline batteries – Lead acid and Li batteries


Reference Books:
17CH2004 CHEMISTRY OF TRANSITION AND INNER TRANSITION ELEMENTS

Credits: 3:0:0

Course Objectives:
Enable the student to
- Learn the properties of transition metals and f block elements
- Understand the various theories of coordination chemistry.
- Learn the principles of organometallic chemistry

Course Outcomes:
Students will be able to
- Know the properties of transition metal compounds.
- Have complete understanding of formation of coordination complexes
- Know the various types of isomerism in coordination chemistry
- Understand the factors affecting the stability of metal complexes
- Apply the 18 electron rule.
- Recognize the importance of f block elements.

Unit I - Transition Metals:

Unit II - Coordination compounds:

Unit III - Isomerism and Stability in Coordinate compounds:
Isomerism – Polymerization isomerism – Ionization isomerism – Hydrate isomerism – Linkage isomerism – Coordination isomerism – Coordination position isomerism – Geometric isomerism or Stereo isomerism – optical isomerism – Stability – Relationship between stepwise and overall stability constant

UNIT IV - Organometallic Chemistry:

Unit V - Inner Transition Elements:

Reference Books:
Course Objectives:
Enable the student to
- learn various types of reaction mechanisms
- expect the reaction products and the changes that occur in the structure of organic compounds interacting depending on the type of interactions
- know the role of heterocycles in organic, pharmaceutical and biological chemistry.

Course Outcomes:
Students will be able to
- elucidate the mechanisms of organic reactions
- propose more complex syntheses
- predict the reactivity of an organic compound from its structure
- develop the knowledge on the fundamental theoretical understanding of heterocyclic chemistry
- propose syntheses of heterocycles from the major classes
- get the ability to relate significant chemical properties to structure


Unit III - Addition and Elimination Reactions: Addition reactions - Electrophilic, Nucleophilic, and free-radical addition to double and triple bonds – Hydration, Hydroxylation, Michael addition, Hydroboration - Addition to carbonyl compounds – Mannich reaction – Elimination reactions – mechanism – E1, E2 mechanisms, Hofmann, Saytzeff rules, Bredt’s rule – Chugaev reaction, Hofmann degradation

Unit IV - Heterocyclic Chemistry with one hetero atom: Heterocyclic Chemistry – one hetero atom - pyrrole, furan, thiophene, Pyridine – Preparation, reactions and properties.

Unit V - Heterocyclic Chemistry with two hetero atom: Heterocyclic Chemistry – two hetero atom – pyrazole, imidazole, thiazole, Piperdine – Preparations, reactions and properties

Reference Books:

Credits: 3:0:0
Course Objectives:
Enable the student to
- learn the fundamental properties of liquid state and liquid crystals
- understand the principles of colloidal state and surface phenomena
- learn the kinetics of chemical reactions

Course Outcomes:
Students will be able to
- understand the properties of liquid state and liquid crystals
* recognize the importance of surface energy
* know about the colloidal system and their stability
* understand the origin of charges on colloidal particles
* distinguish the kinetics of various types of chemical reactions
* understand the factors affecting the enzyme catalysed reactions

UNIT I - LIQUID CRYSTALS: The vacancy theory - Vapour pressure - Surface tension & surface energy - Some effects of surface tension - Interfacial tension - Surface active agent - Liquid crystal- introduction - Vapour pressure – temperature - Classification of liquid crystal – smetic and nematic - Compounds exhibiting both smetic and nematic characters


UNIT V - KINETICS: Chemical kinetics – introduction -Rate of reaction, rate constant, order of reaction - Integration of rate expression for first order reaction - Integration of rate expression for second order reaction - Half-life of first and second order reactions - Catalysis – effect of temperature on reaction rates - Arrhenius equation - Enzyme catalysis

Reference Books:

17CH2007 QUALITATIVE ANALYSIS AND INORGANIC PREPARATIONS LAB

Credits: 0:0:2

Course Objectives:
Enable the student to
- Learn the theoretical basis of qualitative inorganic analysis
- Learn the methods of identification using semimicro analysis
- Get trained for the synthesis of inorganic complexes

Course Outcomes
Students will be able to
- gain the laboratory skills to synthesize the inorganic complexes
- understand the theory and mechanism of formation of metal complexes
- recognize the classification of ions under different groups
- in analyze the mixtures using semi micro analysis
• identify the common ions
• acquire separation skills

12 approved experiments will be notified at the beginning of the semester

Reference Books:

17CH2008 TITRIMETRIC ANALYSIS AND GRAVIMETRIC ANALYSIS LAB

Credits: 0:0:2

Course Objectives:
Enable the student to
• learn quantitative methods of analysis
• understand the importance of titrimetric analysis
• estimate the amount of substance using gravimetric analysis

Course Outcomes:
Students will be able to
• improve their analytical skills with respect to estimation
• recognize the importance of volumetric analysis
• apply the volumetric analysis for the estimation of ions
• understand the theory of various types of titrations
• estimate the amount of substance using gravimetry
• know the theory of gravimetric analysis

12 approved experiments will be notified at the beginning of the semester

Reference Books:

17CH2009 ORGANIC QUALITATIVE ANALYSIS LAB

Credits: 0:0:2

Course Objectives:
Enable the student to
• Identify the functional group of the organic compound
• carryout various types of organic reactions to analyze the organic compound
• Understand the principle of systematic organic qualitative analysis

Course Outcomes:
Students will be able to
• Enhance the knowledge of systematic analysis of an organic compound
• Understand the mechanism of the various reactions.
• Recognize the importance of analyzing a organic compound
• Employ various organic reaction types
• apply the knowledge in analyzing real samples
• Prepare derivatives for the given organic compound

12 approved experiments will be notified at the beginning of the semester

Reference Books:

17CH2010 PHYSICAL CHEMISTRY LAB – I

Credits: 0:0:2

Course Objectives:
Enable the student to
• train the students on instrumental methods of analysis
• carryout experiments on chemical kinetics
• get a basic idea about electrochemistry

Course Outcomes:
Students will be able to
• Understand the principle and working of various instrument methods of analysis.
• apply the principle of chemical kinetics
• apply the knowledge in measuring real samples
• distinguish different terms used to express concentration
• understand the factors affecting the reaction rate
• utilize the knowledge of electroanalytical techniques

12 approved experiments will be notified at the beginning of the semester

Reference Books:

17CH2011 CHEMISTRY IN EVERYDAY LIFE

Credits: 3:0:0

Course Objectives : 
Enable the student to
• learn the chemistry connections of everyday life.
• relate the chemistry involved in day-to-day life
• develop a sense of responsibility towards the environment to safeguard.

Course Outcomes :
Students will be able to
• know the practical aspects of chemistry in day-to-day life.
• apply the chemistry concepts in day-to-day activities.
• think innovative and develop application oriented products.
• gain knowledge in buying certified food products
• make right choice in choosing the right food.
• gain right perspective to guard the environment


**Unit II - PERFUMES, EXPLOSIVES, AND DYES:** Perfumes: historical significance – the olfactory system – categories – chemistry of ice cream making – chemistry of paint – chemistry of explosives – TNT, RDX, nitrocellulose, nitroglycerine (structure and properties only) – natural dyes and synthetic dyes – types, advantages, applications – hair dye – petrochemicals.


**Unit IV - CHEMICAL BASIS PF EVERYDAY PHENOMENA:** Chemical basis of everyday phenomena – reasoning: kitchen gas burner burns yellow when a pot of boiling water overflows – cosmetic creams feel cool when applied to skin – seashells vary in color – old paintings discolor over time – hair color products remove gray on hair – disappearance inks disappear – water does not relieve the burning sensation of chilly – sniffing dogs detect explosives and bombs – flesh of fish smells different from other meat – puff pastries expand when prepared – some fabrics are water-repellent – cotton is highly water absorbent but dries slowly.


**Reference Books:**
4. www.bama.ua.edu/
5. www.foodproductdesign.com
6. www.angelfire.com/linux/chemistryofpaint/
7. www.srsi.org/sr1/weapon.explode.htm
• understand the importance of nanomaterials in electronics and medical field
• think and propose novel materials to replace the present one.


UNIT V - APPLICATIONS OF NANOMATERIALS: Nanoelectronics – Biological applications of nanoparticles – Nanomechnics – Photonic crystals

Reference Books:

17CH3001 CHEMICAL KINETICS AND PHOTOCHEMISTRY

Credits: 3:1:0

Course Objectives:
Enable the student to
• Learn the kinetics of rate equations
• get thorough knowledge about catalysis
• learn the physical properties of electronic excited state

Course Outcomes:
Students will be able to
• understand the types and kinetics of fast reactions
• know the kinetics of flow techniques
• understand the theory of acid – base catalysis
• distinguish different isotherms
• recognize the importance of photosensitization of Chemiluminescence


Reference Books :

17CH3002 CHEMICAL BONDING AND NUCLEAR CHEMISTRY

Credits: 3:0:0

Course Objectives:
Enable the student to
- learn the theory of acids and bases and non-aqueous solvents.
- Know about the various types of chemical bonding.
- Learn about nuclear chemistry and their applications

Course Outcomes:
Students will be able to
- have clear knowledge of theory of acids and bases
- recognize the importance and applications of non-aqueous solvents
- understand the various theories of chemical bonding.
- distinguish different types of interactions in molecules
- understand the theory of Nuclear stability
- identify the applications of nuclear chemistry in various fields


UNIT III - IONIC BONDING: Lattice energy - Born Lande Equation – Born Haber Cycle – Fajan’s rule – Size effects – Factors affecting the radii of ions – Radius Ratio

- VSEPR Theory – Experimental determination of Molecular structure – Berry pseudorotation – Ion-dipole Interaction – Hydrogen Bonding

**UNIT V - NUCLEAR CHEMISTRY:** Nuclear Stability – Nuclear Fission – Nuclear Fusion – Radioactive Detectors - Nuclear Reactions - Neutron Activation Analysis – Carbon and Rock Dating – Applications of Tracers

**Reference Books:**

**17CH3003 ORGANIC REACTION MECHANISM AND STEREOCHEMISTRY**

**Credits:** 3:1:0

**Course Objectives :**
Enable the student to
- impart the importance of chirality in organic compounds
- understand the stereochemistry of organic reactions
- explain the mechanism and molecular rearrangements of organic reactions.

**Course Outcomes :**
Students will be able to
- understand the reaction pathway in organic transformation
- Improve the skill of proposing mechanism for particular reaction
- propose the expected product based on the mechanism
- explain the selectivity in the organic reactions
- enrich the basic understanding on arrangement of atoms or groups in the space.
- reason out the stereoselectivity in organic reactions in the presence chiral environment

**Unit I - REACTION MECHANISM – I:** Effect of structure and reactivity – Resonance and field effects – Steric effects – Quantitative treatments of the effect of structure and reactivity – LFER – Hammet and Taft equation - Importance of $\sigma$ and $\rho$ values in aromatic electrophilic substitutions – Labelling and kinetic isotopic effects. Aromaticity – Hückel’s rule – Aromatic systems with electron numbers other than six – Annulenes and Hetero annulenes.


**Unit III - REACTION MECHANISM – III:** Aromatic electrophilic substitution – Arenium ion mechanism – Orientation and reactivity in monosubstituted benzene rings – Benzene rings with more than one substituent - Effect of leaving group – $\sigma/\rho$ ratio – Addition to C-C-multiple bonds – Mechanisms – Electrophilic, nucleophilic, free radical – Orientation and reactivity – Addition to conjugated systems – Elimination – Mechanisms of $\beta$ elimination – (E2, E1, E1CB) – E1 – E2 – E1CB spectrum, orientation of double bonds – Reactivity – Effect of substrate, attacking base, leaving group and medium.

**Unit IV - STEREOCHEMISTRY – I:** Stereoisomerism – Definitions and classification – Molecular representation and inter conversion – Classification of stereo isomers – Stereoisomerism and center of chirality – Molecules with a single stereogenic center – Projection structure of stereoisomers – Fischer – DL, RS and EZ notations - Configurational nomenclature – Molecules with two or more chiral centers – Stereoisomerism in cyclic compounds – Axial chirality, planar chirality and helicity.

Reference Books:

17CH3004 QUANTUM CHEMISTRY AND GROUP THEORY

Credits: 3:1:0

Course Objectives:
Enable the student to
• learn the importance of quantum chemistry
• understand the concepts of group theory to atoms and molecules.
• know the importance of quantum chemistry and group theory in spectroscopy

Course Outcomes:
Students will be able to
• understand the importance and application of quantization in molecular energy levels
• explain the shape, energy of atomic orbitals and molecular orbitals and the bond formation between atoms
• reason out the spectral behavior of molecules and atoms
• appreciate the symmetry in molecules and in nature
• able to identify and group the objects or molecules of same category based on the symmetry elements
• correlate between symmetry and spectral behavior


UNIT II - QUANTUM CHEMISTRY OF ATOMS AND MOLECULES Scroodinger equation-derivation, Free particle, particle in one dimensional box, three dimensional box Harmonic oscillator, – Rigid rotor – The Schrodinger equation for hydrogen atom – Angular momentum – Spin, coupling of angular momentum – Spin-orbit coupling. Variation and perturbation theory – Application of perturbation / variation theorems to ground state of helium atom

UNIT III - QUANTUM CHEMISTRY OF BONDING: Antisymmetry and Pauli’s exclusion principle – Aufbau principle – Slater detrimental wave functions – Term symbols and spectroscopic states – Born Oppenheiner approximation –Linear Combination of atomic orbitals (LCAO), MO and VB treatments of
Karunya University

2017

Chemistry

Reference Books:

17CH3005 COORDINATION CHEMISTRY

Credits: 3:1:0

Course Objectives:
Enable the student to
- learn the various bonding theories in coordination chemistry and their application in understanding spectra and magnetism
- understand Reaction Mechanism in Coordination Chemistry
- understand the importance of f-block elements and their applications

Course Outcomes:
Students will be able to
- understand the structure, isomerism and bonding in coordination complexes
- characterize the electronic spectra of metal complexes
- predict the magnetic properties of coordination complexes
- understand the factors affecting the stability of metal complexes
- understand the types of mechanisms in reactions of metal complexes
- recognize the chemistry of lanthanides and actinides and their applications


Unit V: Chemistry of f-block elements: Abundance and Distribution, Uses - Lanthanide Contraction – Magnetic and Spectroscopic properties of Lanthanides - Separation of Lanthanides and Actinides - Transactinides

Reference Books:

17CH3006 MOLECULAR SPECTROSCOPY

Credits: 3:0:0

Course Objectives:
Enable the student to
- learn the principles of Molecular Spectroscopy
- understand the principles of Emission Spectroscopy
- learn the theoretical basis of Mossbauer Spectroscopy

Course Outcomes:
Students will be able to
- know the various regions of the spectrum
- Understand the principle of rotation, vibration and electronic spectroscopy
- Know the principle and applications of NMR and ESR spectroscopy
- Understand the principle and applications of fluorescence spectroscopy
- Know the principle and application of photoelectron and mossbauer spectroscopy
- Elucidate the structure of unknown compounds from the spectroscopic data

Unit I - Electromagnetic radiation and Rotation: Introduction to electromagnetic radiation- Regions of the spectrum, characterisation of electromagnetic radiation, Introduction to rotational spectroscopy, rotational spectra diatomic molecules – the rigid diatomic molecule, selection rules for rotational spectra, Effect of isotopic substitution, the non rigid rotator, Polyatomic molecules- Linear molecules, Techniques and instrumentation and chemical analysis by microwave spectroscopy.

Unit II - Vibration and Ramanspectroscopy: Vibrating diatomic molecule, the simple harmonic oscillator, Anharmonic oscillator, The vibration rotation spectrum of carbon monoxide. Born Oppenheimer approximation: the interaction of rotations and vibrations, Vibrations of polyatomic molecules, different modes of stretching and bending, principles – 3N-6 (5) rule, Overtone and combination frequencies, factors affecting vibrational frequencies, Techniques and instrumentation & applications of infrared spectroscopy, Fermi resonance. Raman
spectroscopy- introduction, quantum theory of raman effect, Classical theory of raman effect- molecular polarizability, Polarization of light and the Raman effect, Pure rotational raman spectra- linear, symmetric top and asymmetric top molecules, Vibrational raman spectra, Mutual exclusion principle, overtone and combination vibrations, techniques and instrumentation of Raman spectroscopy, Electronic spectroscopy of diatomic and polyatomic molecules, Transition moment integral, Predissociation

Unit II - NMR and ESR Spectrometry: NMR spectroscopy - introduction, Nuclear magnetic resonance phenomenon, The absorption process, Relaxation process - spin spin relaxation, Spin lattice relaxation, Chemical shift, factors influencing chemical shift, ESR spectroscopy – introduction, g factor, Spectra of simple organic radicals, Spectra of first row transition metals, Zero field splitting, Kramer’s degeneracy

Unit III - Mossbauer and Photoelectron Spectroscopy: Mossbauer spectroscopy - introduction, principle, Isomer shift, Quadrupole effects, Hyperfine splitting, Applications of Mossbauer spectroscopy, Photoelectron spectroscopy (PES) - Principle, Photoelectron spectroscopy (PES) - instrumentation, Ultraviolet Photoelectron spectroscopy (UPS), X-Ray Photoelectron spectroscopy (XPS), Auger electron spectroscopy

Unit V - Fluorescence Spectroscopy: Fluorescence spectroscopy- introduction, principle, instrumentation, Jablonski diagram, Fluorescence, Phosphorescence, Delayed fluorescence, Characteristics of Fluorescence emission, Fluorescence Lifetimes and quantum yields, Fluorescence Quenching, Resonance energy transfer (RET), Steady state and time resolved Fluorescence.

Reference Books:

17CH3007 - CHEMICAL THERMODYNAMICS AND ELECTROCHEMISTRY

Credits: 3:0:0

Course Objectives:
Enable the student to
- learn the fundamentals of classical thermodynamics
- understand the principles of statistical thermodynamics
- know the concepts of electrochemistry

Course Outcomes:
Students will be able to
- understand the influence of temperature on the molecules
- understand the concept of activity and fugacity
- relate various thermodynamic parameters
- understand the distribution of energy among the molecules
- know the relationship between the molecular functions and the thermodynamic parameters
- describe the theoretical background of electrode kinetics

Unit I - First law of thermodynamics – Heat and work, internal energy, enthalpy and heat capacity of a system – Expansion of an ideal gas and changes in thermodynamic property - Limitation of first law of thermodynamics -


Reference Books :


17CH3008 ORGANOMETALLIC, BIOINORGANIC AND SOLID STATE CHEMISTRY

Credits: 3:1:0

Course Objectives :
Enable the student to
- learn the Structure, Reactions and Catalysis in Organometallic Chemistry
- know the role of metals in biological chemistry
- understand the importance of inorganic photochemistry and Solid State Chemistry

Course Outcomes :
Students will be able to
- recognize the importance of 18 electron rule
- understand the chemistry of various types of transition metal organometallic complexes
- know the applications of organometallic complexes in catalysis
- identify the metal complexes that can be used for solar energy conversion
- understand the role of metals in biology
- distinguish the structures of various solids


Reference Books:

17CH3009 SYNTHETIC METHODOLOGY AND NATURAL PRODUCTS

Credits 3:0:0

Course Objectives :
Enable the student to
• Learn modern Synthetic Methods using Reagents
• understand the chemistry of heterocycles having 2 or more heteroatoms,
• understand the modern methods for molecular fashions applied in pharmaceutical industry.

Course Outcomes :
Students will be able to
• understand the importance of coupling reactions
• apply modern synthetic reagents in organic synthesis
• identify the applications of heterocycles in various fields
• summarize the extraction and structure elucidation of natural products
• describe the steps involved in the synthesis of natural products
• recognize the importance of biomolecules and their functions

Unit I - Modern Synthetic methods : Coupling reactions: Introduction modern synthetic methodology, concept of coupling reactions and it types, oxidative reduction and reductive elimination, Coupling reactions-HECK reaction, Suzuki Coupling, Stille Coupling, Ullmann reaction, catalytic cycles. Synthetic Reagents : NBS, DDQ, DCC, Gilmann Reagents

Unit II - Modern Synthetic methods using Reagents and Multicomponent reaction Modern Synthetic Reagents : Introduction to multicomponent reactions, Design strategies (3MCRs) and types, Streater’s Reaction, UGI reaction, Passinier reaction, Biginelli reactions and its problems
Unit III - Heterocyclic Chemistry: Introduction and Nomenclature, Structure, synthesis, properties and uses of pyrazine, imidazole (5 member rings) and pyridazine, pyrimidine (6 membered rings).

Unit IV - Natural products and structural elucidation: Natural products extraction, General methods of structure elucidation of alkaloids, terpenoids, steroids and anthocyanidines, properties and uses.


Reference Books:

17CH3010 QUALITATIVE AND QUANTITATIVE INORGANIC ANALYSIS LAB

Credits: 0:0:4

Course Objectives:
Enable the student to
- Learn about accurate and precise chemical analysis.
- Learn about the methods used in qualitative inorganic analysis containing common and less common ions
- Classify the various quantitative estimation of metal ions

Course Outcomes:
Students will be able to
- Perform semimicro nalysis
- classify the ions into various groups
- differentiate between common and less common ions
- gain laboratory skills for quantitative estimation
- understand the theory of various types of titrations
- recognize the importance of back titration

Course Description:
12 approved experiments will be notified at the beginning of the semester

Reference Books:
17CH3011 QUALITATIVE AND QUANTITATIVE ORGANIC ANALYSIS LAB

Credits: 0:0:4

Course Objectives:
Enable the student to
- Learn the identification of the functional group of the organic compound
- obtain the practical skills in setting up of an organic reaction
- identify the elements present in the small organic molecules

Course Outcomes:
The student will be able to
- perform the systematic analysis of an organic compound
- Apply the concept of polarity to separate the organic mixture
- identify various functional groups in the organic mixtures
- Analyze the functional group present in the organic compounds
- Evaluate the given organic mixture by confirmative tests and elemental analysis
- Synthesize the derivatives of the given mixture of organic compounds

12 approved experiments will be notified at the beginning of the semester and estimations of phenol, aniline, ascorbic acid and glucose.

Reference Books:

17CH3012 PHYSICAL CHEMISTRY LAB

Credits: 0:0:4

Course Objectives:
Enable the student to
- carryout chemical reaction which would be monitored by electroanalytical and other experimental studies.
- develop skills in the application area of electrochemical techniques experiments.
- Learn the techniques used for kinetics.

Course Outcomes:
Students will be able to
- Apply the physical chemistry concepts in chemical kinetics
- Handle the experiments like Conductometry, Spectrophotometry, Potentiometry.
- Understand the importance of the velocity of the reaction, distribution properties and adsorption studies.
- Recognize the factors affecting the rate of the reactions
- Understand the importance of absorption studies.
- Apply the practical knowledge and its solving route.

Course Description:
12 approved experiments will be notified at the beginning of the semester

Reference Book
17CH3013 MODERN INSTRUMENTAL ANALYSIS LAB

Credits: 0:0:2

Course Objectives:
Enable the student to
- understand theory, instrumentation, and applications of separation techniques
- carry out simple chemical reactions that would be monitored by Conductometry Potentiometry, Spectrophotometry techniques.
- to understand theory, instrumentation, and applications of FT-IR and PXRD

Course Outcomes:
Students will be able to
- handle various analytical techniques like Conductometry Potentiometry, Spectrophotometry and X-ray Diffraction
- Describe physical and chemical principles involved in instrumental analysis and Practical skills
- Understand the principles of data acquisition and data analyses.
- Interpret analytical data and communicate the information about identification of different materials.
- solve qualitative and quantitative analytical problems.
- Choose the instrument for specific characterization

Course Description:
12 approved experiments will be notified at the beginning of the semester

Reference Book

17CH3014 PREPARATIVE INORGANIC CHEMISTRY LAB

Credits: 0:0:2

Course Objectives:
Enable the student to
- learn the Basic principles of formation of Inorganic complexes
- provide the students an appreciation for the preparation of Inorganic complexes.
- obtain knowledge pertaining to the appropriate selection of instruments for the successful analysis of complex mixtures

Course Outcomes:
Students will be able to
- know the concept of preparation techniques.
- gain the laboratory skills to prepare the inorganic complexes.
- Purify and check the purity of the prepared compounds
- understand the mechanism of the various preparative synthetic steps.
- apply the theory of infrared and ultraviolet spectroscopic techniques.
- characterize the inorganic complexes by spectroscopic techniques

Course Description:
12 approved experiments will be notified at the beginning of the semester

Reference Books:

17CH3015 SYNTHETIC ORGANICCHEMISTRY LAB

Credits: 0:0:2

Course Objectives:
Enable the student to
- Develop various skills for preparing organic compounds.
- Know the various organic preparative techniques available.
- Impart awareness about reaction conditions for various types of organic reactions.
Course Outcomes:
Students will be able to
- Design and prepare organic compounds in one step in the lab.
- Purify the prepared organic compound and check the purity of prepared compound.
- Setup the apparatus for various preparative techniques.
- Understand the mechanism of the various preparative synthetic steps.
- Recognize the importance of distillation, refluxing and recrystallization techniques.
- Employ various organic reaction types.

Course Description:
12 approved experiments will be notified at the beginning of the semester

Reference Books:

17CH3016 INSTRUMENTAL METHODS OF ANALYSIS

Credits: 3:0:0

Course Objectives:
Enable the student to
- develop sufficient knowledge about the physical/chemical basis of measurement
- obtain knowledge pertaining to the appropriate selection of instruments for the successful analysis of complex mixtures
- understand the applications of various instrumental techniques

Course Outcomes:
Students will be able to
- understand the range and theories of instrumental methods available in analytical chemistry
- select the appropriate instruments for analyzing complex mixtures
- choose the proper separation technique
- know the importance of thermal methods of analysis
- analyze the sample using microscopic techniques
- recognize the importance of instrumentation techniques in water, food and body fluid analysis

Unit I - Data Analysis: Errors in chemical analysis – Defining terms: mean, median, accuracy and precision – classification of errors: Systematic errors and random errors. Improving accuracy of analysis – mean, standard deviation and Q-test - Principles of Titrations – Instrumental Techniques – Classification – Modern Analytical Techniques

Unit II - Chromatographic methods: Classification – techniques and applications in column, size-exclusion, ion exchange, paper and thin layer chromatography. Gas chromatography and high performance liquid chromatography (HPLC) – principle, equipment design, sample injection system, columns, detectors and applications.

Unit III - Thermal Methods of Analysis: Thermal Characterization techniques Principle and applications of Differential Thermal Analysis (DTA), Differentials Scanning Calorimetry (DSC) and Thermogravimetric Analysis (TGA) Thermometric titration - Theory – Instrumentation – Factors affecting TG, DTA and DSC Curves – Applications


Reference Books:

17CH3017 MAIN GROUP CHEMISTRY

Credits: 3:0:0

Course Objectives:
Enable the student to
• Understand the synthesis, structure, bonding, and reaction mechanisms of main group Compounds
• learn the chemistry of inorganic polymers
• To understand the bonding in Inorganic cages and clusters

Course Outcomes:
Students will be able to
• understand the structure and bonding in main group Chemistry
• recognize the importance of inorganic polymers
• understand the structure and bonding in inorganic cages and clusters.
• describe the chemical reactivities of B-O, B-N, silicones, polyphosphazene and (SN)compounds.
• know the importance of the electron counting rules
• prepare different Boron hydrides compounds

Unit I - Chemistry of Alkali and Alkaline Earth Metals: Periodic property, Synthesis of Crown ether and Cryptands, Application of Crown ethers in extraction of alkali and alkaline earth metals; Compounds of Beryllium-Aqua and hydroxo complexes, Beryllium chloride, Carbonates, Carboxylates, Dimethylberyllium, Beryllium azide, Grignard reagents and their application.

Unit II - Polymorphism and Allotropy: Allotropes of carbon-Fullerenes, Carbon nanotubes, Diamond, Graphite(synthesis, structure and applications); Allotropes of Phosphorus-Synthesis, Structureand Properties; Allotropes of Sulphur-Classification, Synthesis, Structureand Properties

Unit III - Chemistry of B and C Group Elements: Bonding, Preparation and Structure-Hydrides of boron, Boron oxides, Oxoacids, Borates, Aminoboranes; Chemistry of Silicates; Organometallic Compounds of B, Al, Si, Sn, Pb, and Bi-Synthesis, Structure and Reactions

Unit IV - Chemistry of N,O, Halogen and Noble group Elements: Oxides and oxyacids of S, Se, Te and N-Synthesis, Structures and Properties; Interhalogens,Polyhalides, Pseudohalides- Synthesis and Structure; Xenon compounds- Synthesis and Structure

Reference Books:

17CH3018 SYNTHETIC REAGENTS AND CONCERTED REACTIONS

Credits 3:0:0

Course Objectives:
Enable the student to
- rationalize, control, and predict the behavior and outcomes of organic reactions
- understand the fundamental principles of Pericyclic and photochemical reactions
- expand and utilize the skills in designing organic synthesis through retrosynthetic approach

Course Outcomes:
Students will be able to
- understand the mechanisms involved in various naming reactions to synthesize their target molecules
- select the appropriate reagents for oxidation and reduction reactions
- know the principles and applications of Pericyclic reactions.
- develop the required skills to execute the various types of Concerted reactions
- design photochemical reactions
- synthesize complex molecules through retrosynthetic approach

Unit I - Organic Name Reactions and Reagents Based On Oxidation and Reduction: Reagents based on Oxidation – PCC – OsO₄ - Reagents based on Reduction – NaBH₄, LiAlH₄, DIBAL – Name reaction based on Oxidation – Swern Oxidation and Baeyer Villiger Oxidation - Name reaction based on Reduction – Birch Reduction, Meerwein-Ponnordf-Verley Reduction.


Unit III - Photochemistry of alkenes and aromatic compound: Olefin photochemistry – conjugated olefins – Isomerisation and rearrangements – Cis trans isomerisation – valence isomerisation – rearrangement of 1,4 and 1,5 dienes – di π-methane rearrangement - Cope and Claisen rearrangement – cycloaddition reactions – Photochemistry of Aromatic compounds – Arenephotoisomerisation – Photodimerisation – Cycloaddition reactions – 1,2 cycloadditions – Photooxygenation – ene reaction.

cycloaddition – concerted Vs Non-concerted cycloaddition - 2+2 and Diel's Alder reaction – Reactivity of dienophile and diene components – orientation – stereochemistry of Diel’s Alder reaction.


**Reference Books :**

**17CH3019 SPECTROSCOPIC METHODS FOR STRUCTURE ELUCIDATION**

**Credits: 3:0:0**

**Course Objectives:**
Enable the student to
- learn the principles of Molecular Spectroscopy to Organic Molecules
- characterize the organic molecule using various spectroscopic technique
- derive the structure of the molecule using the spectroscopic techniques

**Course Outcomes:**
Students will be able to
- Understand the principle and applications of UV-Visible and IR spectroscopy
- Elucidate the structure of the unknown compounds using the provided UV Visible and IR spectroscopic data
- Know the principle and applications of NMR spectroscopy
- Classify the types of 2D NMR spectroscopy
- Understand mass spectrometry
- Derive the structure of the unknown organic molecule using the provided spectroscopic data


**Unit II - FTIR spectroscopy:** FTIR – principle, instrumentation & the infrared absorption process,FTIR – modes of stretching and bending. Finger print region correlation chart and tables, concept of combination bands and overtones, factors influencing vibrational frequencies,IR spectrum of hydrocarbons: alkanes, alkenes and alkynes,
aromatic rings, alcohols, phenols, ethers and related problems, IR spectrum of carbonyl compounds - aldehydes, ketones and related problems, IR spectrum of carboxylic acids and esters and related problems, IR spectrum of amides, acid chlorides and anhydrides and related problems, IR spectrum of amines, nitriles, isocyanates, isothiocyanates, imines, nitro compounds and related problems, IR spectrum of sulfur, phosphorous, alkyl and aryl compounds and related problems, Problems in IR spectroscopy.

**Unit III - ¹H NMR spectroscopy:** NMR: Principle, the phenomenon of magnetic resonance, Instrumentation, Chemical shift, spin – spin relaxation and spin – lattice relaxation, Spin-spin coupling, problems based on ¹H NMR spectroscopy, Factors influencing chemical shift, Coupling constant- one bond, two bond, three bond and long range coupling.

**Unit IV - Multinuclear and 2D NMR spectroscopy:** ¹³C spectroscopy- principle and instrumentation, Difference between ¹H and ¹³C NMR spectroscopy, problems on ¹³C NMR spectroscopy, Proton decoupled ¹³C spectra, Simplification of complex spectra, Nuclear Overhauser Enhancement Effect (NOE), Second order spectra, DEPT spectra, problems on DEPT spectra, ¹H-¹H COSY spectroscopy, HETCOR spectroscopy, NOESY, ROSEY- definition, Problems on ¹H, ¹³C, 2D NMR and DEPT spectroscopy – Introduction to ³¹P, ¹⁹F and Silicon spectroscopy

**Unit V - Mass spectrometry:** Mass spectrometry: Principle – Instrumentation, Ionization methods – Electron ionization, Chemical ionization, Desorption ionization techniques, Electrospray Ionisation (ESI), Mass spectrum – Molecular ion peak – Base peak Metastable ions, Nitrogen rule, odd even rule, Fragmentation patterns - McLafferty rearrangement - Isotopic effect - Combined structure problems (with all spectral data, DBE, FTIR, ¹H, ¹³C NMR, DEPT, Mass)

**Reference Books:**

**17CH3020 Supramolecular Chemistry and Green Chemistry**

**Credits:** 3:0:0

**Course Objectives:**
Enable the student to
- learn the supramolecular constructs of current importance.
- Understand the principles of formation of various types of supramolecular architecture
- Know the importance of solid state supramolecular chemistry and green chemistry

**Course Outcomes:**
Students will be able to
- Understand the various types of bonding in supramolecular chemistry
- know the selectivity in formation of supramolecular chemistry and catalysis.
- synthesize and assemble molecular structures of different shapes and dimensions.
- understand the importance of green chemical pathways in reactions and their applications.
- Construct supramolecular architecture based on of crystal engineering concepts
- Recognize the application of supramolecular chemistry in various fields

**UNIT I - INTRODUCTION TO SUPRAMOLECULAR CHEMISTRY:** Introduction to supramolecular chemistry – Selectivity – Lock and key principle and induced fit model – complementarity – Co-operativity and chelate effect – Pre-organization – Binding constants – Kinetic and thermodynamic selectivity.

**UNIT II - SOLUTION HOST–GUEST CHEMISTRY:** Introduction: guests in solution – Macrocyclic vs. acyclic hosts – High-dilution synthesis – Template synthesis – Cation binding – Crown ethers and cryptands – Spherands – Heterocrowns – Biological ligands: ion channels – Anion binding – Charged receptors – Neutral receptors – Lewis acid receptors – Neutral molecule binding – Calixarenes, cyclodextrins and dendrimers as catalysts.


UNIT V - GREEN CHEMISTRY: Need of Green chemistry-Twelve principles of Green chemistry- Green solvents- supercritical carbon dioxide-water as solvent-solvent-free synthesis- applications of Green chemistry- Environmental benign synthesis- catalysis

Reference Books :

17CH3021 APPLIED ELECTROCHEMISTRY

Credits: 3:0:0

Course Objectives:
Enable the student to
• understand the basics of electrode kinetics
• learn the applications of electroanalytical techniques
• know the types corrosion of materials and electroplating procedures

Course Outcomes:
Students will be able to
• understand the basics of electrokinetics
• know the types electroanalytical techniques
• understand the types of corrosion of materials and electroplating procedures
• choose the methods to resist corrosion
• understand the principles of electrochemical energy conversion
• classify the batteries based on their application


Unit IV - Electrochemical Power Sources – I: Principles of energy conservation - Electrochemical energy conservation- Thermodynamic reversibility - Gibb’s equation - Classification of batteries, types of electrolytes - Battery characteristics - Battery specifications - Battery components, Evaluation of battery performance.

Unit V - Electrochemical Power Sources – II: Construction and characteristics of primary batteries: Dry Leclanche cells, alkaline primary batteries and family of lithium batteries - Secondary batteries: Lead acid – car, traction, stationary, standby and sealed batteries. Nickel cadmium – pocket plates and sintered plates – vented and
sealed maintenance free designs. Fuel cells- Introduction, types of fuel cells, advantages – Photoelectrochemical cells.

**Reference Books :**

**17CH3022 MOLECULAR AND MATERIALS SELF-ASSEMBLY**

**Credits: 3:0:0**

**Course Objectives:**
Enable the student to
- Learn the different types of assembly of nanomaterials
- know the bottom-up approach in nanotechnology based on self-assembly.
- Classify the molecular and materials self-assembly on the basis of the driving force needed for them to form.

**Course Outcomes:**
Students will be able to
- understand the formation of self-assembly in nanomaterials
- describe the process of bottom-up approach based on self-assembly
- give examples of nanocluster self-assembly
- design self-assembled monolayers through different approaches
- understand the fundamental principles of self-assembling block co-polymers
- relate significant self-assembled properties to structure

**Unit I - Fundamentals of Self-Assembly and Self-Assembled Monolayers:** Self-assembly: definition – Molecular vs. materials self-assembly – Hierarchical self-assembly – Forms, patterns and functions – Self-assembled monolayers (SAMs) – Soft lithography – Microlens arrays – Transfer printing – Electrically contacting SAMs – SAM crystal engineering - Switching SAM function – Chemical reactions on SAMs – Applications of SAMs.


**Unit V - Self-Assembling Block Copolymers:** Block copolymer self-assembly – Nanostructured ceramics – Block copolymer thin films – Electrical ordering – Spatial confinement of block copolymers – Block copolymer
lithography – Decorating block copolymers – Nanowires from block copolymers – Making micelles – Harnessing rigid rods – Block co-polypeptides – Block copolymer bio-factories.

Reference Books:

17CH3023 – POLYMER CHEMISTRY

Credits: 3:0:0

Course Objectives:
Enable the student to
- know the classification and mechanism of polymer formation
- Understand the characterisation techniques used in polymer chemistry
- know concepts of polymer nanocomposites.

Course Outcomes:
Students will be able to
- acquire the basic knowledge about polymers
- choose the methods for characterizing the polymer
- understand the thermal and mechanical properties of various polymers
- develop various fabrication techniques
- understand the filler-matrix interaction
- recognize the importance and applications of nanofillers


Unit II - Principles and mechanisms of polymerization – addition, step growth polymerization and coordination polymerization (Zeigler-Natta) - reactivity of functional groups – Carothers equation – Kinetics – characteristics of step growth polymerization – examples – mechanisms, choice of polymers, effect of inhibitors or retarders – copolymerization - monomer reactivity - ratio, composition, types, the Q-e scheme.


Unit V - Introduction to – conducting polymers and composites, applications in sensors, batteries – conventional composites – filler-matrix interaction, continuous (or long) and short fibre reinforced composites, laminates – introduction to polymer nanocomposites – clay, CNT, particle filled – Advantages and limitations of nanofillers – Surface treatment on nanofillers – Applications of polymer nanocomposites – packaging, automotive, mechanical components
Reference Books:

14CH3024 ANALYTICAL CHEMISTRY

Credits: 3:0:0

Course Objectives:
Enable the student to
- Learn the importance of various analytical techniques used in chemistry
- Understand the principles of different chromatographic separation techniques
- Know the principles and applications of spectroscopic techniques and thermal methods

Course Outcomes:
Students will be able to
- Distinguish between different chromatographic techniques
- Select appropriate technique for analysis
- Plan the analysis of any prepared compound
- Utilize the proper spectroscopic technique for the characterization
- Interpret the spectra obtained from various techniques
- Apply the thermal methods and X-ray diffraction methods

UNIT I – CHROMATOGRAPHY: Theory, instrumentation, basic principles and applications of the following – Column, thin layer, and ion-exchange chromatography – HPLC - applications in chemical analysis – Gas chromatography
UNIT IV - NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY
Reference Books:

17CH3025 MEDICINAL CHEMISTRY

Credits: 3:0:0

Course Objectives:
Enable the student to
- equip with a thorough understanding of different aspects of pharmaceutical chemistry
- learn about the enzyme kinetics
- understand the various steps and procedures in the drug design

Course Outcomes:
Students will be able to
- understand and apply the design and synthetic approaches used in pharmaceutical chemistry
- recognize the importance of enzyme kinetics
- identify the factors affecting the solubility of the drugs
- know the process of pharmokinetics
- understand the importance of clinical trials
- design some small organic drug molecules

Unit I - Basics of medicinal chemistry:
Brief history of medicinal chemistry – classification of drugs – brief description of biological, chemical, computer revolutions in drug design – pro drugs and soft drugs – design of pro drug system – multiple pro drug formation – soft drug principle and applications

Unit II - Drug targets and drug solubility:
Enzymes and enzyme inhibitors – competitive and non-competitive inhibitors – reversible and irreversible inhibitors – ligand-receptor theories – Clark’s theory and Paton’s rate theory – proteins, lipids, and nucleic acids as drug targets – effect of pH, pKa, and polarity on drug solubility

Unit III - Pharmcokinetics and drug metabolism:
Natural resources of lead compounds – absorption, distribution, metabolism, and elimination – oxidation and hydrolysis – testing drugs in vitro – high-throughput screening – testing drugs in vivo – therapeutic index and therapeutic ratio


Unit V - Development of new drugs:

Reference Books:

17CH3026 SUPRAMOLECULAR CHEMISTRY

Credits: 3:0:0

Course Objectives:
Enable the student to
- Learn the structural and functional basics of building blocks of supramolecular structures
- Know driving forces of supramolecular structure formation
- Classify the supramolecules based on structure and the chemistry behind host-guest assembly.

Course Outcomes:
Students will be able to
- understand the selectivity in supramolecule formation
- identify the various factors affecting the formation of supramolecules
- understand the concepts of solution host-guest chemistry
- design the various types of supramolecular architectures
- recognize the importance of coordination polymers
- apply the supramolecules in various fields

Unit I - INTRODUCTION TO SUPRAMOLECULAR CHEMISTRY: Introduction to supramolecular chemistry – Selectivity – Lock and key principle and induced fit model – complementarity – Co-operativity and chelate effect – Pre-organization – Binding constants – Kinetic and thermodynamic selectivity – Optically active supra-molecules – Self-assembly of intrinsically chiral molecular capsules.


Reference Books:
2. Jean-Marie Lehn, Supramolecular Chemistry, RCS pubs., 2005
LIST OF COURSES

<table>
<thead>
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<tr>
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<td>Reaction Mechanism and Heterocyclic Chemistry</td>
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<td>10</td>
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</table>

16CH1001 APPLIED CHEMISTRY

Credits: 3:0:0

Course Objectives
To impart knowledge on
- Understanding the problems associated with hard water and treatment methods.
- Thermodynamic concepts and energy resources
- The importance of corrosion control methods
- Polymers and types and applications of Materials

Course Outcomes
The students will be able to
- Get a compendium of applicable knowledge on Chemistry
- Understand the Hard Water Treatment methods
- Apply the knowledge of thermodynamics and Electrochemistry concepts
- Utilize the knowledge of advanced materials

Course Description:

Reference Books

16CH1002 APPLIED CHEMISTRY FOR ENGINEERS

Credits: 3:0:1

Objectives
The course aims to impart knowledge on
- Various types of bonding interactions
- Water Purification Processes
- Role of polymer in engineering applications
- Effect of additives in food and Health
- Need for alternative energy and nanochemistry

Outcome
At the end of the course, the student will learn
- About the chemistry of factors affecting the quality of water, food and health
- The importance of polymers in various fields and corrosion control methods
- About the significance of clean energy and nanochemistry


References

Experiments (Any Ten Experiments)
1. Determination of Hardness in water
2. Determination of dissolved oxygen in water
3. Estimation of Alkalinity in water
4. Estimation of iron in water by spectrophotometry
5. pH based experiment by pH Meter
6. pH based experiment using conductivity bridge
7. Softening of water by ion exchange method
8. Estimation of Iodine in iodized salt
9. Estimation of Calcium in milk powder
10. Synthesis of Aspirin
11. Analysis of Milk Adulteration
12. Analysis of oil
13. Calorie measurement
14. Estimation of Fe^{2+} by potentiometry
15. Estimation of copper in alloy
16. Synthesis of nanoparticles
16CH2001 CHEMICAL BONDING AND CONCEPTS OF ACIDS AND BASES

Credits : 3:0:0

Course Objectives:
- To impart knowledge about various kinds of bonding in inorganic chemistry.
- To impart the concepts of acids and bases

Course outcomes:
The Students will
- Understand the basics of bonding interactions
- Have a clear understanding of acid base theory.

Course Description:

Reference Books:

16CH2002 ORGANIC REACTION INTERMEDIATES AND STEREOCHEMISTRY

Credits: 3:0:0

Objective:
- To impart basic understanding about reaction intermediates
- To illustrate the concepts of electronic effects
- To highlight the importance of stereoisomerism and conformation

Outcome:
The students will get
- The understanding on the structural basics of organic compounds and their reactions
- Knowledge on the reactions of carbonyl and nitrogen containing compounds

Course Description:
Classification and Nomenclature of organic compounds – Electrophiles and nucleophiles – Carbocation and Carbanion, Free radicals, Arynes - Inductive effect and field effect – Hyperconjugation – Tautomerism – Aliphatic and Aromatic nitrogen containing compounds – Aliphatic and Aromatic carbonyl compounds - Stereoisomerism – Cis-trans isomerism – E, Z nomenclature – Optical isomerism – Absolute configuration – R, S nomenclature – Cahn, Ingold, Prelog nomenclature – Conformation of ethane and cyclohexanes
Reference Books:

16CH2003 ATOMIC STRUCTURE, THERMODYNAMICS AND ELECTROCHEMISTRY

Credits: 3:0:0

Objective:
To illustrate
- The basics of Quantum Chemistry
- The principles of chemical thermodynamics and electrochemistry
- The importance of Phase Rule

Outcome:
The student will be able to
- Understand the importance of Quantum Chemistry
- Know the importance of Thermodynamics and Electrochemistry
- Understand the significance of Phase rule

Course Description:

Reference Books:
16CH2004 CHEMISTRY OF TRANSITION AND INNER-TRANSITION ELEMENTS

Credits: 3:0:0

Course Objectives:
- To impart knowledge about transition metal inorganic chemistry.
- To explain the various theories of coordination chemistry.
- To illustrate the importance of f-block elements and their applications

Course outcomes:
The students will
- Know the properties of transition metal compounds.
- Understand the theory behind the formation of coordination complexes
- Know the importance of inner transition elements

Course Description:

Reference Books:

16CH2005 – REACTION MECHANISM AND HETEROCYCLIC CHEMISTRY

Credits: 3:0:0

Objective:
- To discuss various types of reaction mechanisms
- To introduce the chemistry of heterocyclic compounds

Outcome:
- Get a thorough knowledge on organic reaction mechanisms
- Get knowledge on the preparation and properties of heterocycles

Course Description:
Substitution reactions – Aliphatic nucleophilic - $S_N1$ and $S_N2$ mechanisms – Aromatic nucleophilic - $S_Ar$ mechanism – Benzyne mechanism – Aliphatic Electrophilic - $S_E1$ and $S_E2$ mechanisms – Aromatic Electrophilic - Arenium ion mechanism – Neighboring group participation - Hammett equation - Elimination reactions – $E_1$, $E_2$ mechanisms - Addition reactions – Heterocyclic Chemistry – One hetero atom - Pyrrole, Furan, Thiophene – Two hetero atom – Pyrazole, Imidazole, Thiazole – Reactions and properties.
Reference Books:

16CH2006 SURFACE CHEMISTRY AND CHEMICAL KINETICS
Credits: 3:0:0

Objective:
- To illustrate the fundamental properties of liquid state and liquid crystals
- To impart the knowledge on the principles of colloidal state and surface chemistry
- To demonstrate the significance of kinetics and Catalysis

Outcome:
The students will understand
- The basics of Liquid state and Liquid Crystals
- The importance of Colloidal substances and surface chemistry and their applications
- The importance of Kinetics and Catalysis

Course Description:

Reference Books:
16CH3001 RESEARCH METHODOLOGY

Credits: 3:0:0

Course Objective:
- To equip the students to undertake thorough literature survey
- To impart knowledge on scientific writing and scientific communication.
- To create an awareness about the good lab practices and scientific ethics.

Course Outcome:
The student will be able to
- Understand the principle of literature survey
- Prepare scientific reports
- Follow good lab practices and scientific ethics

Course Description:

Reference Books
2. R. Panneerselvam, Research Methodology, PHI learning Pvt. LTD, 2014

16CH3002 MOLECULAR AND MATERIALS SELF ASSEMBLY

Credits: 3:0:0

Objective:
- To explain the formation of self assembly in nanomaterials
- To distinguish molecular and materials self-assembly

Outcome:
- Able to understand the forces behind the formation of self assembly in nanomaterials
- Have the knowledge on the bottom-up approach based on self assembly

Course Description:

References:
## LIST OF SUBJECTS

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<td>15CH3028</td>
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15CH2001 POLYMER SCIENCE AND TECHNOLOGY IN MEDICINE

Credits: 3:0:0

Course Objective
- To enlighten the basic understanding of polymers and composites
- To impart knowledge on processing and the fabrication of polymeric materials
- To acquire knowledge on the bio-medical applications of polymers and its composites

Course Outcome
- Students would be familiar with the fundamental concepts and technology of polymer
- They would also acquire the knowledge on polymeric nano-composites
- They would be able to formulate and develop the polymer composite materials for bio-medical applications

Course Description:

Reference Books :
Course Objectives:
- To teach the fundamentals of various bio-materials
- To impart knowledge on processing and application of ceramic materials, bioactive glasses and glass ceramic materials
- To highlight the knowledge on bio-coatings and its relevance in medical field

Course Outcome:
- The students would understand various applications of ceramic materials in the medical field.
- The students would be able to formulate and fabricate various bio-ceramic materials for bio-medical applications.
- To have a complete knowledge about the various calcium phosphates based ceramic materials along with the preparation, properties and applications.

Course Description:

Reference Books:
15CH2003 CHEMISTRY IN EVERYDAY LIFE

Credits: 3:0:0

Course Objectives:
- To introduce to the students about the chemistry connections of everyday life.
- To relate what the student studies in the subjects to practical life.

Course Outcome:
- The students will know the practical aspects of chemistry in day-to-day life.
- The students will think innovative and develop application oriented products.

Course Description:
Drugs and Diseases-Causes, Sign and Symptoms of Polio, Diabetes, AIDS, Cancer- Vaccination-Protein Misfolding and disease—Banned Drugs and its effect-Structure based Antibiotics and Antipyretics, Common drugs-Chemistry of Paints, Ice cream, Explosives, Hair dye- Advantages and Disadvantages with structure of monoglumatate (Aginomotto), Caffeine and Theobromine (in chocolates), Docosahexanoic acid (in fish), Alpha tocopherol (in body lotions), Aspartame (Artificial Sweetener)- Chemical Phenomena-Seashells vary in color- Water does not relieve the burning sensation of chilly-Sniffing dogs detect explosives and bombs-Flesh of Fish smells different from other meat-Cotton is highly water absorbent but dries slowly-Food adulteration-Fast food and organic food-Cholesterol (LDL and HDL)- Molecules of Emotion (Adrenaline, Dopamine, Epinephrine, Serotonin, and Oxytocin).

Reference Books:
4. www.bama.ua.edu/
5. www.foodproductdesign.com
6. www.angelfire.com/linux/chemistryofpaint/
7. www.ssrsi.org/srl/weapon.explode.htm
15CH3001 CHEMICAL KINETICS AND PHOTOCHEMISTRY

Credits: 3:1:0

Course Objectives :
• To understand the Dynamics of Chemical Kinetics, Catalysis, Surface Chemistry & Photochemistry.

Course Outcome :
• Students will acquire a good knowledge on the chemical kinetics, unimolecular and bimolecular reactions, fast reactions, Catalysis, Surface chemical reactions and Photochemistry of atoms and molecules.

Course Description:

Reference Books :
15CH3002 CHEMICAL BONDING AND NUCLEAR CHEMISTRY

Credits: 3:0:0

Course Objectives:
- To explain the theory of acids and bases and non-aqueous solvents.
- To discuss the various types of chemical bonding.
- To discuss nuclear chemistry and their application in various fields.

Course Outcome:
- Students will have thorough knowledge of theory of acids and bases
- The students will understand the theories of chemical bonding.
- The students will know the importance of nuclear chemistry and its applications

Course Description:

Reference Books:
15CH3003 ORGANIC REACTION MECHANISM AND STEREOCHEMISTRY

Credits: 3:1:0

Course Objectives:
- To enable the student to understand the stereochemistry of organic reactions
- To explain the mechanism and molecular rearrangements of organic reactions.

Course Outcome:
- Students can carry out organic reactions with proper understanding and knowledge of mechanism and orientation changes.

Course Description:

Reference Books:
15CH3004 QUANTUM CHEMISTRY AND GROUP THEORY

Credits: 3:1:0

Course Objectives:
- To study the importance of quantum chemistry
- To understand the applications of group theory to atoms and molecules.

Course Outcome:
- Students acquire a good knowledge on the fundamentals of quantum chemistry and the practical applications of group theory.

Course Description:

Reference Books:
15CH3005 COORDINATION CHEMISTRY

Credits: 3:1:0

Course Objectives:
- To discuss the Bonding, Spectra, Magnetism and Reaction Mechanism in Coordination Chemistry
- To understand the importance of f-block elements and their applications

Course Outcome:
- The Students will understand the structure, bonding and reaction mechanism in coordination complexes
- The students will understand the chemistry of lanthanides and actinides

Course Description:

Reference Books:
15CH3006 MOLECULAR SPECTROSCOPY

Credits: 3:0:0

Course Objectives:
- To understand the principles of Molecular Spectroscopy
- To discuss the principles of Emission Spectroscopy
- To understand the importance of Mossbauer Spectroscopy

Course Outcome:
- Students will know the principles of Rotation, Vibration and Electronic Spectroscopy
- The students will know the importance of NMR and ESR Techniques.
- The students will know the principles of Mossbauer and Photoelectron Spectroscopy

Course Description:

Reference Books:
15CH3007 CHEMICAL THERMODYNAMICS AND ELECTROCHEMISTRY

Credits: 3:0:0

Course Objectives:
- To know about classical & statistical thermodynamics.
- To understand the fundamental and applied concepts of electrochemistry

Course Outcome:
- Students acquire a good understanding of the basic principles of thermodynamics and electrochemistry.

Course Description:

Reference Books:
Course Objectives:
- To discuss the Structure, Reactions and Catalysis in Organometallic Chemistry
- The Bioinorganic Chemistry of elements will be discussed
- To understand the importance of inorganic photochemistry and Solid State Chemistry

Course Outcome:
- The Students will understand the importance and applications of Organometallic chemistry, Bioinorganic Chemistry, Inorganic Photochemistry and Solid State Chemistry

Course Description:

Reference Books:
15CH3009 SYNTHETIC METHODOLOGY AND NATURAL PRODUCTS

Credits 3:0:0

Course Objectives:
- To enable the student to understand Modern Synthetic Methods using Reagents, Heterocycles and its allied natural products, (c) the modern methods for molecular fashions applied in pharmaceutical industry.

Course Outcome:
- Students will be aware of Heterocyclic compounds and its medicinal use; they will get the knowledge about the molecular fashions in the pharmaceutical industry through the modern reactions and reagents.

Course Description:

Reference Books:
15CH3010 QUALITATIVE AND QUANTITATIVE INORGANIC ANALYSIS LAB

Credits: 0:0:4

Course Objectives :
- To provide the students a competence in the laboratory skills required for accurate and precise chemical analysis.
- The students will know the theoretical basis of qualitative inorganic analysis containing common and less common ions.

Course Outcome :
- The student will gain the laboratory skills to estimate quantitatively by using complexometric and redox titrations
- The student can confirm the presence of less common and common ions in the mixtures using semimicro analysis.

Course Description :
The faculty conducting the Laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

Reference Books :

15CH3011 QUALITATIVE AND QUANTITATIVE ORGANIC ANALYSIS LAB

Credits: 0:0:4

Course Objectives :
- To enrich the knowledge of Organic Laboratory skills for estimation and analysis of Organic mixture.

Course Outcome :
- Students acquire the knowledge of estimation and analysis of Organic Compounds
- The student can characterize the unknown compound using functional group Analysis.

Course Description :
The faculty conducting the Laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

Reference Books:
15CH3012 PHYSICAL CHEMISTRY LAB

Credits: 0:0:4

Course Objective:
- To carry out simple chemical reaction which would be monitored by Electrical and Non-Electrical experimental studies.

Course Outcome:
- The analytical skill will be improved by pursuing electrical experiments like Conductometry, Spectrophotometry, Potentiometry.
- The basic knowledge could be understood thoroughly regarding the velocity of the reaction, distribution properties and adsorption studies.

Course Description:
The faculty conducting the Laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

Reference Book

15CH3013 MODERN INSTRUMENTAL ANALYSIS LAB

Credits: 0:0:2

Course Objective:
- To carry out simple chemical reaction which would be monitored by Electroanalytical and Spectrophotometric Techniques

Course Outcome:
- The student will be exposed to various analytical techniques like Conductometry Potentiometry, Spectrophotometry and X-ray Diffraction

Course Description:
The faculty conducting the Laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

Reference Book
15CH3014 PREPARATIVE INORGANIC CHEMISTRY LAB

Credits: 0:0:2

Course Objectives:
- To provide the students an appreciation for the preparation and Characterization of Inorganic Complexes.

Course Outcome:
- The student will gain the laboratory skills to prepare the inorganic complexes,
- The student will be able to characterize the inorganic complexes using IR and UV Spectroscopy

Course Description:
The faculty conducting the Laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

Reference Books:

15CH3015 SYNTHETIC ORGANIC CHEMISTRY LAB

Credits: 0:0:2

Course Objectives:
- Employ various reaction types to synthesize organic compounds and characterize them using Spectra.

Course Outcome:
- Understanding of the reaction conditions for various organic reactions
- The student can able to analyze the purity of the compound using Thin Layer Chromatography and interpret the spectroscopic data of the organic compounds

Course Description:
The faculty conducting the Laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

Reference Books:
Credits: 3:0:0

Course Objectives:
- To understand the principles of Instrumentation Techniques
- To understand the applications of various analytical techniques

Course Outcome:
- Students will know the principles of various types of chromatographic techniques.
- The students will know the principles of Thermal methods, Atomic Spectroscopy and X-ray Diffraction.
- The students will know the application of instrumental techniques in various fields

Course Description:

Reference Books:
Course Objective:
- To understand the structure and bonding in Main group Compounds
- The chemistry of Inorganic Polymers
- To understand the bonding in Inorganic cages and clusters

Course Outcome:
- The Students will understand the structure and bonding in main group Chemistry
- The students will know the importance of inorganic polymers
- The students will understand the structure and bonding in inorganic cages and clusters.

Course Description:
Alkali and alkaline earth metals - Crown ether complexes and cryptands – Compounds of Berylium - Polymorphism of Carbon, Phosphorus and Sulfur – Carbides – Silicates - Oxides and oxyacids of Se and Te - Interhalogens - Xenon compounds - Homocyclic inorganic systems - p-d bonding - Inorganic Polymers – Classification - Chemistry of B-O compounds and B-N compounds - Silicones, Polyphosphazene and (SN)x - Coordination Polymers - Metal-organic frameworks - Boron hydrides – styx numbers – Heteroboranes – Carboranes – Metal Clusters - d bonding – Examples

Reference Books:
15CH3018 SYNTHETIC REAGENTS AND CONCERTED REACTIONS

Credits 3:0:0

Course Objective:
- To enable the student to understand the principles of organic synthesis, Reagents used in organic synthesis (c) Photochemical, Pericyclic, and different Molecular rearrangements.

Course Outcome:
- Students can make use of different reagents in organic synthesis and they can do it in different pathways.

Course Description:

Reference Books :
15CH3019 SPECTROSCOPIC METHODS FOR STRUCTURE ELUCIDATION

Credits: 3:0:0

Course Objective:
- To apply the principles of Molecular Spectroscopy to Organic Molecules
- To Characterize the organic molecule using various spectroscopic technique
- To derive the structure of the molecule using the spectroscopic techniques

Course Outcome:
- Students will apply the principles of organic UV-Visible and IR spectroscopy
- To characterize Molecules using NMR and Mass spectrometry techniques
- The students will derive the structure of the organic molecule using the provided data

Course Description:

Reference Books:
15CH3020 SUPRAMOLECULAR CHEMISTRY AND GREEN CHEMISTRY

Credits: 3:0:0

Course Objectives:
- The students will learn the supramolecular constructs of current importance.
- Information on concepts of modern chemistry which aids the students get motivated and prepared to do research after their masters.
- A knowledge on synthesizing and assembling molecular structures of different shapes and dimensions.

Course Outcome:
- The students will know the selectivity in formation of supramolecular chemistry and catalysis.
- They will understand the importance of green chemical pathways in reactions and their applications.

Course Description:

Reference Books:
15CH3021 APPLIED ELECTROCHEMISTRY

Credits: 3:0:0

Course Objectives:
- Understand the basic concepts of electroanalytical techniques
- To gain familiarity with applications of electrochemistry
- Build confidence and knowledge to deal independently with electrochemical problems

Course Outcome:
- Students acquire a good knowledge on the fundamentals and applications of electrochemistry

Course Description:

Reference Books:
15CH3022 MATERIALS CHEMISTRY

Credits: 3:0:0

Course Objectives:
- To explain the synthesis, characterization and properties of materials.
- To demonstrate the applications of materials in various fields

Course Outcome:
- The students will get knowledge on the various types of materials and their synthetic strategy
- The student will understand the applications of material chemistry

Course Description:

Reference Books:

15CH3023 BIOMOLECULAR CHEMISTRY

Credits: 3:0:0

Course Objectives:
- To discuss the structure and functions of biomolecules
- To understand the influence of biomolecules in bodily processes.
- The student will be exposed to separation and classification of large molecules.

Course Outcome:
- The students will get knowledge about the structure, properties and action of biomolecules.

Course Description:

Reference Books:
15CH3024 ORGANOTRANSITION METAL CHEMISTRY

Credits: 3:0:0

Course Objectives:
- To discuss the Structure and bonding in various transition metal organometallic compounds
- To understand the reaction mechanism in organometallic reactions
- To know the recent advances in Bioorganometallic Chemistry and the applications of catalysts in organic Synthesis and Polymer Chemistry

Course Outcome:
- The Students will understand the importance of organometallic chemistry,
- To use the organometallic catalysts in various fields.

Course Description:

Reference Books:
1. Didier Astruc, Organometallic Chemistry And Catalysis Springer-Verlag Berlin Heidelberg 2007
2. Robert H. Crabtree, Organometallic Chemistry of the Transition Metal, Wiley
15CH3025 CHEMINFORMATICS

Credits: 3:0:0

Course Objectives:
- The graphical way of representation of chemical structures will be discussed
- The Concepts of Molecular Descriptors and Structure - activity relationship will be discussed
- Similarity Methods will be discussed

Course Outcome:
- The students gain knowledge on representation of chemical structures and the importance of QSAR and its use

Course Description:

Reference Books:
15CH3026 ENVIRONMENTAL ELECTROCHEMISTRY

Credit: 3:0:0

Course objectives:
Student will learn on topics linking environmental issues such as
- Environmental phenomena,
- Environmental protection, remediation
- Manmade environmental damages, with electrochemical phenomena.

Course Outcome:
- The students will be exposed to basics in electrochemistry, and
- Electrochemically oriented environmental issues.

Course Description:

Reference Books:
15CH3027 MOLECULAR MACHINES AND MATERIALS

Credits: 3:0:0

Course Objectives:
- The students will learn the advanced concepts and the molecular nanotechnology of the future viz., molecular machines and switches.
- Information on modern chemistry which aids the students get motivated and prepared to do research after their masters.
- Imparting knowledge on the conceptual foundations of the possible near future inventions of miniature molecular devices.

Course Outcomes:
- The students will understand the working principles of molecular machines and materials and the ways of assembling new molecular machines.
- They will learn the structure, function, and applications of molecular machines, switches, and devices.

Course Description:

Reference Books:
15CH3028 SELF ORGANIZATION AND SELF-ASSEMBLY IN NANOSTRUCTURES

Credits: 3:0:0

Course Objectives:
- The students will learn the structural chemistry of popular nanoconstructs of current importance.
- Information on modern chemistry which aids the students get motivated and prepared to do research after their masters.
- A knowledge on the scaling laws of nanochemistry.

Course Outcomes:
- The students will know the selectivity in formation of molecular and materials self-assembly and the factors governing it.
- They will learn the structure, function, and applications of nanochemistry in developing new ideas related to medicine and energy applications.

Course Description:

Reference Books:
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### 14CH1001 APPLIED CHEMISTRY

**Credits: 3:0:0**

**Objective:**
- To understand problems associated with hard water and treatment methods.
- To learn about fabrication of polymers, industrially important polymers and their bio-degradability.
- To know about calorific value of fuels, methods to improve anti-knocking characteristics, bio-fuels and flue gas analysis.
- To have understanding about construction and working of batteries, corrosion – types and control methods.
- To impart the basic aspects of inorganic engineering materials.
Outcome:
- To suggest methods to minimize problems related to hard water in industrial operations.
- To select and use eco-friendly fuels and biodegradable polymers for industrial and domestic purpose.
- To use appropriate methods to minimize corrosion of metals.

Course Description:

Reference Books:

14CH1002 APPLIED CHEMISTRY LAB

Credits: 0:0:2

Objective:
- To train the students in gaining hands on experience to handle various applied chemistry laboratory techniques.

Outcome:
- The students can apply their theoretical applied chemistry knowledge in practical applications

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

14CH1003 ENVIRONMENTAL STUDIES

Credits: 3:0:0

Objective:
- To acquire knowledge of elements of environment, it’s need & importance.
- To know about pollution problems and green technology.
- To develop a sense of responsibility about the role of students in fostering the idea of learning to live in harmony with nature.
- To create an awareness about the major environmental issues for a sustainable development.

Outcome:
- At the end of this course the students are expected to understand the importance of environment, the effect of technology on the environment and ecological balance
- To make the students sensitive to the environment problems in every professional endeavor in which they participate.

Course Description:

Reference Books:

14CH2001 BASIC INORGANIC CHEMISTRY

Credits: 3:0:0

Objective:
- To explain the importance of atomic structure and chemical bonding.
- To get thorough knowledge about various kinds of bonding in inorganic chemistry
- To expose to theory of acids and bases.

Outcome:
- Students will have the knowledge of atomic structure
- The students will know the basis of various types of bonding.
- The students will have a complete understanding of acid base theory

Course Description:

Reference Books:

14CH2002 TRANSITION METAL AND COORDINATION CHEMISTRY

Credits: 3:0:0

Objective:
- To explain the various theories of coordination chemistry
- To explain the nomenclature and isomerism in coordination compounds
- To get thorough knowledge about transition metal inorganic chemistry
Outcome:
- The students will know the properties of transition metal compounds
- Students will have the complete understanding of formation of coordination complexes
- The students will know the importance of crystal field theory

Course Description:

Reference Books:

14CH2003 ADVANCED INORGANIC CHEMISTRY

Credits: 3:0:0

Objective:
- To explain the importance and properties of F-block elements.
- To explain the fundamentals of organometallic and bioinorganic chemistry
- To expose to inorganic copolymer chemistry

Outcome:
- Students will have the thorough knowledge of chemistry of f-block elements
- The students will know the importance of organometallic chemistry and bioinorganic chemistry.
- The students will know the applications of important inorganic polymers

Course Description:

Reference Books:
14CH2004 QUALITATIVE ANALYSIS AND INORGANIC PREPARATIONS LAB

Credits: 0:0:2

Objective:
- To provide the students an appreciation for the synthesis of Inorganic Complexes.
- To provide the students a competence in the laboratory skills required for accurate and precise chemical analysis.
- The students will know the theoretical basis of qualitative inorganic analysis containing common and less common ions.

Outcome:
- The student will gain the laboratory skills to synthesize the inorganic complexes
- will be confident in analyzing the mixtures containing common and less common ions using semimicro analysis
- Their separation skills will be improved

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

14CH2005 TITRIMETRIC ANALYSIS AND GRAVIMETRIC ANALYSIS LAB

Credits: 0:0:2

Objective:
- To enrich the knowledge of estimation through titrimetric
- To gain some insights towards gravimetric skills
- To improve the Quantitative analytical skills

Outcome:
- Students acquire the knowledge of acidimetry and permanganometry,
- They understand the importance of iodometry, complexometry and dichrometry
- They can estimate any compound by gravimetry.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

14CH2006 BASIC ORGANIC CHEMISTRY

Credits: 3:0:0

Objective:
- The student will get rudimentary ideas on chemical structure
- Versatile knowledge about the formula of organic Molecules.
- The student will have an idea about stereoisomerism and conformation in chemical structure and properties of molecules.

Outcome:
- The students will get the understanding on the structural basics of organic compounds
- They will understand the nomenclature of Organic compounds
- To Understand the stereoisomerism and conformation of organic molecules

Course Description:
Classification and Nomenclature of organic and heterocyclic compounds – Electrophiles and nucleophiles – Carbocation and Carbanion, Free radicals, Arynes - Inductive effect and field effect – Hyperconjugation –
Tautomerism - Substitution reactions, Addition reactions, Elimination reactions, Rearrangement reactions – Kinetic and thermodynamic control - Stereoisomerism – Cis-trans isomerism – E, Z nomenclature – Optical isomerism – Absolute configuration – R, S nomenclature – Cahn, Ingold, Prelog nomenclature - conformation and configuration – Conformation of ethane and cyclohexanes

Reference Books:

14CH2007 ALIPHATIC AND AROMATIC CHEMISTRY

Credits: 3:0:0

Objective:
- The student will be exposed to ideas about Aliphatic and aromatic compounds, their preparation and chemical properties.
- The student will learn about some common organic reactions
- To have an idea about the molecular rearrangements.

Outcome:
- The students will get knowledge on the reactions of carbonyl and nitrogen containing compounds
- They gain the knowledge about the molecular rearrangements
- They gain insights about features of commonly used name reactions

Course Description:
Aliphatic carbonyl compounds – Aliphatic nitrogen containing compounds – Aromatic aldehydes and ketones – Aromatic carboxylic acids – mono and dicarboxylic acids - Aromatic nitrogen containing compounds – Azines - Arenediazonium salts – Aldol, Perkin, Dieckman condensations – Reimer-Tiemann, Grignard reactions – Gattermann reaction, Friedel-Crafts reaction, Wittig reaction, Clemmensen reduction, Baeyer-Villiger reaction, Fries reaction, Stevens, Benzil-benzilic acid rearrangement, Curtius rearrangement, Hoffmann rearrangements

Reference Books:

14CH2008 BASIC REACTION MECHANISM

Credits: 3:0:0

Objective:
- Chemical reactions, which are mostly used to synthesize compounds of various types, and their mechanism, are discussed.
- Distinguishing the types of reactions and their mechanism will give an idea of the structural requirements of reactions of a particular type.
The student will be able to write a reaction by explaining which bonds are broken and in what order.

**Outcome:**
- The students will get a thorough knowledge on the operating in the reactions of organic compounds and mechanism.
- Learn to identify the reaction mechanism
- Students can design new organic reactions based on the knowledge about reaction mechanism

**Course Description:**
The S<sub>N</sub>Ar mechanism – illustration with an example - benzyne mechanism – illustration with an example - S<sub>N</sub>1 and S<sub>N</sub>2 mechanisms – illustration with an example - neighboring group participation – Examples - Arenium ion mechanism – illustration with an example - Hammett equation – S<sub>E</sub>2 mechanism – illustration with an example - S<sub>E</sub>1 mechanism – illustration with an example - Addition reactions - illustration with an example - Elimination reactions – mechanism – illustration with an example - E<sub>1</sub>, E<sub>2</sub> mechanisms - illustration with an example -

**Reference Books:**

**14CH2009 ORGANIC QUALITATIVE ANALYSIS LAB**

**Credits:** 0:0:2

**Objective:**
- Enable to identify the functional group of the organic compound
- To obtain the practical skills in setting up of an organic reaction
- To prepare small organic molecules as derivatives

**Outcome:**
- Knowledge of systematic analysis of an organic compound
- The students will have the knowledge of identifying the functional groups of the organic compounds
- They will equip themselves in the preparation of simple organic compounds and understand their mechanism

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

**14CH2010 ORGANIC PREPARATIONS LAB**

**Credits:** 0:0:2

**Objective:**
- Employ various reaction types to prepare organic compounds
- To train themselves in setting up of an organic reaction
- To have knowledge about handling the chemicals and laboratory scale preparations

**Outcome:**
- Understanding of the reaction conditions for various organic reactions
- They will equip themselves in the preparation of simple organic compounds
- They understand the mechanism of the reactions
The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

**14CH2011 THERMODYNAMICS AND KINETICS**

**Credits: 3:0:0**

**Objective:**
- To study the physical properties of solids
- To get thorough knowledge about the principles of chemical thermodynamics
- To study the chemical equilibrium and the chemical kinetics of reactions

**Outcome:**
- To know the physical characteristics of solids
- To understand the thermodynamic principles
- To understand the concepts of chemical equilibrium and chemical kinetics

**Course Description:**

**Reference Books:**

**14CH2012 ELECTROCHEMISTRY, CATALYSIS AND COLLOIDAL CHEMISTRY**

**Credits: 3:0:0**

**Objective:**
- To study the fundamental concepts of electrochemistry
- To study the principles of quantum chemistry and surface chemistry
- To study colloidal chemistry and phase equilibria

**Outcome:**
- To get a basic knowledge about electrochemistry
- To understand the theory involved in quantum chemistry and surface chemistry
- To come to know about the colloidal solutions and phase equilibria of one and two component systems

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2014  |  Department of Chemistry
Course Description:

Reference Books:

14CH2013 PHOTOCHEMISTRY, NUCLEAR CHEMISTRY AND CORROSION

Credits: 3:0:0

Objective:
- To study the fundamental concepts of photochemistry
- To study the principles of radiochemical reactions
- To study the applied concepts of electrochemistry

Outcome:
- To get a basic knowledge about photochemical reactions
- To understand the concepts of radiochemistry and its applications
- To understand the advanced applications of electrochemistry

Course Description:

Reference Books:
14CH2014 PHYSICAL CHEMISTRY LAB – I

Credits: 0:0:2

Objective:
- To train the students on instrumental methods of analysis
- To carry out experiments on chemical kinetics
- To get an basic idea about electrochemistry

Outcome:
- Understand the principle and working of various instrument methods of analysis.
- To apply the principle of chemical kinetics
- To apply the knowledge in measuring real samples

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

14CH2015 PHYSICAL CHEMISTRY LAB – II

Credits: 0:0:2

Objective:
- To do experiments based on phase rule and absorption.
- To do experiments based spectrophotometry
- To gain some idea in distribution coefficient and equilibrium constant

Outcome:
- To apply principles of absorption, phase rule, distribution coefficient and equilibrium constant
- To understand applications of spectrophotometry
- To apply the knowledge in measuring real samples

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

14CH2016 CHEMISTRY FOR CIVIL ENGINEERS

Credits: 3:0:0

Objective:
- To understand the application of composites as building materials
- To familiarize the student with various types of testing and treatment of water and sewage
- To impart the basic knowledge of chemical composition of building materials
- To learn the application of organic binders and paints

Outcome:
- Students will have the knowledge of chemistry concepts of building materials, organic binders and road marking paints
- Students will have complete understanding of the testing and treatment methods of water and sewage

Course Description:
Reference Books:

14CH2017 CHEMISTRY FOR MECHANICAL AND AEROSPACE ENGINEERS

Credits: 3:0:0

Objective:
- To explain the fundamentals of Protective coatings and surface chemistry
- To get thorough knowledge about Composite materials and Alloys

Outcome:
- The students will know the phase rule and composition behind the various metal alloys
- Students will have the complete understanding of fabrication of polymer composites

Course Description:

Reference Books:

14CH2018 CHEMISTRY FOR ELECTRICAL AND ELECTRONICS ENGINEERS

Credits: 3:0:0

Objective:
- To know the significance of electromagnetic radiation and its interaction
- To understand the basic concepts about the photochemistry
- To know the importance of semiconductors and device fabrication
- To study the superconducting materials, lithography and energy storage devices
- To know about new generation materials used in LEDs and in other applications

Outcome:
- Students will have the wide spectrum of knowledge in electromagnetic radiation, photochemical reaction and its applications.
- The students will understand basic concepts of semiconductor, superconductors and LEDs.
Course Description:

Reference Books:

14CH2019 CHEMISTRY FOR COMPUTER ENGINEERS

Credits: 3:0:0

Objective:
● To know about fundamentals of materials chemistry and various classes of materials
● To study the characterization of materials by analytical techniques
● To know about photolithography and its applications

Outcome:
● The students will know the basics of materials chemistry
● The students will understand the application of materials in diversified fields

Course Description:

Reference Books:

14CH2020 CHEMISTRY FOR BIOLOGISTS

Credits: 3:0:0

Objective:
● To have a thorough knowledge in preparing solutions for analytical testing
● To get an idea about the applications of the chromatography and microscopy
● To enable the students to understand the concepts in physical and chemical processes in living systems
● To provide an introduction to the basic analytical tools needed for experiments in Biology.
Outcome:
- The students will have the fundamental ideas on preparation of solution which are essential for wet analytical science
- They will understand the applications of microscopy and chromatography
- They gain some rudimentary ideas on solutions, colloids, and surfaces which are essential for wet analytical science

Course Description:
Mole concept. Principle of volumetric analysis acidity, alkalinity and buffer solutions - Free energy, enthalpy and entropy. Energetics of Metabolism and ATP cycle – Chemical potential – Gibbs Duhem equation – Statements and applications of distribution laws (without derivation) – Physical significance - Adsorption- Langmuir and Freundlich isotherms. BET equation (no derivation) and its application to surface area measurement. Sols (reversible and irreversible), Emulsions and Emulsifiers, Association colloids (micelles), Gels - Applications of colloids - Paper, thin-layer, gel-filtration, ion-exchange, affinity and High-Performance Liquid Chromatography (HPLC). Principles of Light, confocal, fluorescence and electron microscopy

Reference Books:

14CH2021 CHEMISTRY FOR FOOD SCIENCE ENGINEERS

Credits: 3:0:0

Objective:
- To get an understanding about the chemistry involved in Foods and Dyes
- To have a thorough knowledge in preparing solutions for analytical testing of Food
- To get an idea about the applications of the chromatography and microscopy

Outcome:
- Students will understand the chemistry involved in modern foods and drinks
- They will have a knowledge about the pigments and dyes used in day today life
- Student will have an introduction to the basic analytical tools needed for experiments in Biology.

Course Description:

Reference Books:
6. Seema Yadav, Food Chemistry, Anmol publishing (P) Ltd, New Delhi

14CH2022 STRUCTURAL CHEMISTRY FOR BIOLOGISTS

Credits: 3:0:0

Objective:
- This course will cater to the students learning Biology–related subjects as their main course, in providing them knowledge of the chemical structures of biomolecules and molecules involved in biochemical pathways.

Outcome:
- The student will be able to systematically name organic and biomolecules, identify them, and understand the importance of these molecules in biological pathways.
- They can understand the structural requirement of molecules and drugs in achieving physiological functions and pharmacological actions.
- Molecular mechanisms taught in biology will be better understood, through a chemistry approach with a newer vista.

Course Description:

Reference Books:

14CH2023 APPLIED NANOCHEMISTRY AND NEXT GENERATION MATERIALS

Credits: 3:0:0

Objective:
- The course will cover several key aspects of applied nanomaterials namely their synthesis, characterization, processing, and applications

Outcome:
- The students will know the various types of nanomaterials
- Students will have the complete understanding of properties and applications of nanomaterials

Course Description:

Reference Books:

14CH3001 POLYMER CHEMISTRY

Credits: 3:0:0

Objective:
- To acquire knowledge about the basic principles of polymers
- To understand the moulding processes of polymers
- To understand the applications of polymers

Outcome:
- To get a basic knowledge about polymers
- To know their properties and various fabrication techniques
- To comprehend polymer nanocomposites and their applications

Course Description:

Reference Books:

14CH3002 NANO CHEMISTRY

Credits: 3:0:0

Objective:
- To acquire the basic knowledge about nanochemistry
- To study the synthetic techniques of nanomaterials
- To study the applications of nanomaterials

2014 | Department of Chemistry
Outcome:
- To know the processes involved in zero-dimensional, one-dimensional and two-dimensional nanomaterials
- To understand the methodologies to synthesize special nanomaterials
- To understand the characterization techniques

Course Description:

Reference Books:
5. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, Overseas Press, 2005

14CH3003 NANOTECHNOLOGY FOR ENERGY APPLICATIONS

Credits: 3:0:0

Objective:
- To acquire the basic knowledge about energy sources
- To study the electrochemical devices
- To study the principles of fuel cells and nuclear energy devices

Outcome:
- To know the chemistry and application of nanotechnology for energy sources
- To specifically understand the role of nanomaterials in solar cells, electrochemical devices, hydrogen storage and nuclear power devices
- To understand the applications of energy devices

Course Description:
Introduction to Energy Sources - Basic principle and operation of renewable energy resources - Nanotechnology for solar power - Nanotechnology for electrochemical devices - Lithium-ion batteries – Fuel cells – Characterization and evaluation of nanomaterials for proton exchange membrane fuel cells (PEMFC), Biofuel cells (BFC) solid oxide fuel cells (SOFC) - Nanotechnology for hydrogen storage materials - Development of hydrides for nanomaterials - Nanotechnology for Nuclear Power - Ni-Cr-Mo alloys for nuclear engineering – Nanocatalysis-Radiation protection materials – nanostructured Boron steels.

Reference Books:

14CH3004 ANALYTICAL CHEMISTRY

Credits: 3:0:0

Objective:
- To explain the importance of various analytical techniques used in chemistry
- To understand the principles of various analytical techniques
- To understand the applications of various analytical techniques

Outcome:
- Students will know the principles of various types of chromatographic separation techniques.
- The students will know the importance of electromagnetic spectrum.
- The students will apply the various spectroscopic techniques for structure elucidation of small molecules

Course Description:

Reference Books:

14CH3005 CHEMICAL APPROACH TO NANOMATERIALS

Credits: 3:0:0

Objective:
- Soft lithographic patterning on the basis of chemistry will be discussed.
- The theory of materials preparation with soft building blocks and large building blocks will be taught to the students.
- The question of how chemistry uses bioinspiration for material preparation will be addressed.

Outcome:
- The student will get a thorough knowledge of molecular and material self assembly
- The students will know the importance of soft lithography
- The students will know the importance of bioinspired materials
**Course Description:**

**Reference Books:**

**14CH3006 MEDICINAL CHEMISTRY**

**Credits:** 3:0:0

**Objective:**
- To equip the students with a thorough understanding of different aspects of pharmaceutical chemistry
- To make them understand about the enzyme kinetics
- To gain some insights about the drug design

**Outcome:**
- After finishing this course, the student will be able to understand and apply the design and synthetic approaches used in pharmaceutical chemistry
- They will have the knowledge of enzyme kinetics
- They will be trained to design some small organic drug molecules

**Course Description:**

**Reference Books:**

14CH3007 SUPRAMOLECULAR CHEMISTRY

Credits: 3:0:0

Objective:
- As the students have known the structural and functional basics of building blocks of supramolecular structures, he/she will now be taught how to build up such structures.
- A knowledge on the driving forces of supramolecular structure formation will be given to the student.
- The student will be exposed to ideas on the types of supramolecules based on structure and the chemistry behind host-guest assembly.

Outcome:
- The students will know the selectivity in supramolecule formation and various factors affecting it
- The students will know the complete understanding of solution host-guest chemistry
- The students will know the various types of supramolecular architectures

Course Description:

Reference Books:
2. Jean-Marie Lehn, Supramolecular Chemistry, RCS pubs., 2005

14CH3008 CORROSION SCIENCE AND ENGINEERING

Credits: 3:0:0

Objective:
- To improve both the fundamental knowledge of the students about the corrosion of Materials.
- To introduce various types of corrosion
- The knowledge of the contemporary concepts for corrosion processes of metallic materials will be thought.

Outcome:
- Students will know the various types of corrosion
- The students will know the thermodynamics and kinetics of corrosion
- To know the corrosion prevention methods
Course Description:

Reference Books:

14CH3009 NANOTECHNOLOGY FOR MEDICINAL APPLICATIONS

Credits: 3:0:0

Objective:
- To provide an introduction and involvement of Nano-scale formulated molecules/materials in the Medicinal Applications
- To provide the basic knowledge of nano-sized molecules in diagnostic applications.
- To explain the importance of nano-fabrication for therapeutic application, in addition to theragnostics applications

Outcome:
- Students will have the knowledge of nano-sized designs for various medicinal applications
- Loading and delivery of nano drugs through liposomal drug delivery
- Students will know the techniques of internalization with the help of vector and receptor strategy.

Course Description:
Nano formulations and measurement of size based system - liposomal, polysomal approach – nano sized drugs for Diagnostics, Therapeutic – In-vivo - Clinical Applications – Nano fabrications for Theragnostics Applications. Potential nano scale materials and molecules for internalization and its techniques – Activation technology through Nano molecules and its potential applications – Receptor and Vector approaches with nano molecules, Drug Targeting approaches with nano molecules - Cellular Labeling approaches with nano molecules

Reference Books:
4. Harry F. Tibbals, Medical Nanotechnology and Nanomedicine, 2010,
14CH3010 POLYMERS FOR NANOTECHNOLOGY

Credits: 3:0:0

Objective:
- To teach the basic knowledge about the polymers
- To study the concept of nanotechnology applied in polymer technology
- To have a basic idea about the nano composites

Outcome:
- Students would be able to understand the basic concepts of the polymers.
- They would be able to formulate and develop new polymer nano-composites for various industrial applications.
- They would be trained in the fabrication of Polymer nano composites.

Course Description:
Introduction to material – metal, polymer and ceramic- Conventional composite – particle filled, long and short fibre and fabric reinforced- Introduction to Nanocomposites - advantages and limitations of nano-fillers; surface treatment on nano-fillers- Fabrication of polymer nano-composites - compounding and moulding techniques - Tribology of polymer nanocomposite – Introduction to friction, wear and lubrication; advantages of polymers over metal; tribology of conventional polymer composites; tribology of polymer Nanocomposites- Influence of the size of the reinforcing filler on the wear mechanism-Applications of polymeric Nanocomposites in various fields.

Reference Books:

14CH3011 TECHNICAL TEXTILES

Credits: 3:0:0

Objective:
- To impart basic knowledge on fibre science
- To make the students understand the processing of textiles
- To make the students realize the need for smart textiles

Outcome:
- The student will acquire basic knowledge on fibre science
- The student will understand the interaction of fibres with dyes and finishes.
- The student will realize the need for nanotechnology in the field of textile chemistry (smart textiles)

Course Description:
Introduction to natural and synthetic fibres – properties and processing – preparation, mercerization, dyeing, printing and finishing – coatings and laminates, Chemical modification of fibres and fabrics for different end uses – Chemistry of dyes and intermediates, Testing of textile materials for various mechanical and structural properties -
Smart textiles – self-cleaning fabrics, antibacterial finish with nano particles, anti shrink, wrinkle free, flame retardant, conductive textiles, textile based sensors, medical textiles, wound care materials, water proof and breathable fabrics, geotextiles.

Reference Books:

14CH3012 METALS IN BIOLOGY

Credits: 3:0:0

Objective:
- To explain the importance of role of metals in biology
- To get thorough knowledge about various function of metals in various real system
- To expose the students to model compounds

Outcome:
- The students will know the importance of trace elements in biology
- Students will have the knowledge functions of metals in various real systems
- The students will know about mimicking nature for the benefit of mankind

Course Description:

Reference Books:
6. Stephen j. Lippard;jeremy m. Berg, principles of bioinorganic chemistry, panima publishing corporation, 2005
7. Hanson, Graeme; Berliner, Lawrence (Eds.), Metals in Biology, Springer, 2010