

Academic Calendar & Plan

Distribution of syllabus into Modules and Units of B.Sc. Honours Course CBCS

Department of Chemistry
Sarat Centenary College, Dhaniakhali, Hooghly

Semester-1

Orientation Programme – 1st week of July: General outline of Chemistry syllabus and its Scope & Importance

Ist Module(July to September)

Core Course I: Organic Chemistry-I

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10,
Attendance-05

Name of the teacher: Dr.Sanjay Mondal

Unit 1: Fundamentals in Organic chemistry

1. Bonding and Physical Properties: Valence Bond Theory Electronic displacements, MO theory, Physical properties
2. General Treatment of Reaction Mechanism I: Mechanistic classification, Reactive intermediates

Practical:

1. Separation of Organic compound

Core Course II: Physical Chemistry-I

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher: Mrs. Pallabi Acharyya

Unit 1: Kinetic Theory and Gaseous state

1. Kinetic Theory of gases
2. Maxwell's distribution of speed and energy
3. Real gas and virial equation

Unit 2: Chemical Thermodynamics

1. Zeroth and 1st law of Thermodynamics
2. Thermochemistry

Practical

1. Determination of pH of unknown solution (buffer), by color matching method;
2. Determination of the reaction rate constant of hydrolysis of ethylacetate in the presence of an equal quantity of sodium hydroxide;
3. Study of kinetics of acid-catalyzed hydrolysis of methyl acetate

2nd Module (October to December)

Core Course I: Organic Chemistry

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10,
Attendance-05

Name of the teacher: Dr.Sanjoy Mondal

Unit 2: Stereochemistry-I

Practical:

1. Determination of boiling point

Internal Assessment: 1st Week of December

Theory and Practical Examination: as per notification of B.U. (Tentatively on December)

Core Course II: Physical Chemistry-I

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Mrs. Pallabi Acharyya

Unit 2: Chemical Thermodynamics

3. Second Law of Thermodynamics
4. Thermodynamic relations

Unit 3: Chemical kinetics

1. Rate law, order and molecularity
2. Role of Temperature and theories of reaction rate
3. Homogeneous catalysis
4. Autocatalysis; periodic reactions

Practical

1. Study of kinetics of decomposition of H₂O₂ by KI;
2. Determination of solubility product of PbI₂ by titrimetric method

Internal Assessment: 1st Week of December

Theory and Practical Examination: as per notification of B.U. (Tentatively on December)

Semesterr-II

1st Module(January to March)

Core Course III: Inorganic Chemistry-I

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher: Dr. Suparna Sadhu

Unit 1: Extra nuclear Structure of atom

Unit 2: Chemical periodicity

Practical

Oxidation-Reduction Titrimetric

1. Estimation of Fe(II) using standardized KMnO₄ solution
2. Estimation of oxalic acid and sodium oxalate in a given mixture
3. Estimation of Fe(II) and Fe(III) in a given mixture using K₂Cr₂O₇ solution.
4. Estimation of Fe(III) and Mn(II) in a mixture using standardized KMnO₄ solution

Core Course IV: Organic Chemistry-II

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher: Dr. Sanjoy Mondal

Unit 1:

1. Stereochemistry II

Practical

1. Organic Preparations

2nd Module (October to December)

Core Course III: Inorganic Chemistry-I

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.Suparna Sadhu

Unit 3: Acid-Base

Unit 4: Redox Reactions and precipitation reactions

Practical

5. Estimation of Fe(III) and Cu(II) in a mixture using $K_2Cr_2O_7$.

6. Estimation of Fe(III) and Cr(III) in a mixture using $K_2Cr_2O_7$.

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

Core Course IV: Organic Chemistry-II

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.SanjoyMondal

Unit 2: Substitution and Elimination Reactions

1. Free-radical substitution reaction
2. Nucleophilic substitution reactions
3. Elimination reactions

Practical

1. Purification of the crude product by Crystalization

Internal Assessment: 4th Week of May

Theory and Practical Examination: as per notification of B.U. (Tentatively on June)

Semester-III

Ist Module(July to September)

Core Course 5 :Physical Chemistry-II (Theo)

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Mrs. PallabiAcharyya

Unit 1: Transport Processes:

- Fick's law
- Viscosity
- Conductance and transport number
- Transport number, Principles of Hittorf's and Moving-boundary method

Unit 2: Application of Thermodynamics – I

- Partial properties and Chemical potential
- Chemical Equilibrium
- Nernst's distribution law
- Chemical potential and other properties of ideal substances- pure and mixtures

Practical

1. Study of viscosity of unknown liquid (glycerol, sugar) with respect to water.
2. Determination of partition coefficient for the distribution of I_2 between water and CCl_4 .
3. Determination of K_{eq} for $KI + I_2 \rightleftharpoons KI_3$, using partition coefficient between water and CCl_4 .

Core Course 6 :Inorganic Chemistry-II

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.Suparna Sadhu

Unit 1: Chemical Bonding-I

1. Ionic bond
2. Covalent bond

Unit 2: Chemical Bonding-II

1. Molecular orbital concept of bonding
2. Metallic Bond

Practical

Iodo/Iodimetric Titrations

1. Estimation of Cu(II).
2. Estimation of Vitamin C.
3. Estimation of arsenite by iodimetric method

Core Course 7 :Organic Chemistry-III

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.SanjoyMondal

Unit 1:

1. Chemistry of alkenes and alkynes
2. Addition to $C\equiv C$ (in comparison to $C=C$)
3. Aromatic Substitution

Practical

Qualitative Analysis of Single Solid Organic Compounds

SEC-1

Basic Analytical Chemistry

Credits: Theory-2, Marks – 50, Theory – 40, Internal Assessment – 10

Name of the teacher: Dr.SanjoyMondal

Unit: 1

1. Introduction
2. Analysis of soil
3. Analysis of wate
4. Analysis of food products

2nd Module (October to December)

Core Course 5 :Physical Chemistry-II (Theo)

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Mrs. PallabiAcharyya

Unit 3: Foundation of Quantum Mechanics

Beginning of Quantum Mechanics
Wave function
Concept of Operators
Particle in a box
Simple Harmonic Oscillator

Practical

4. Conductometric titration of an acid (strong, weak/ monobasic, dibasic) against strong base.
5. Study of saponification reaction conductometrically.
6. Verification of Ostwald's dilution law and determination of K_a of weak acid.

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively in December)

Core Course 6 :Inorganic Chemistry-II

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.Suparna Sadhu

Unit 2: Chemical Bonding-II

3. Weak Chemical Forces

Unit 3: Radioactivity

1. Nuclear stability and nuclear binding energy. Nuclear forces: meson exchange theory. Nuclear models (elementary idea): Concept of nuclear quantum number, magic numbers. 34

2. Nuclear Reactions: Artificial radioactivity, transmutation of elements, fission, fusion and spallation. Nuclear energy and power generation. Separation and uses of isotopes.

3. Radio chemical methods: principles of determination of age of rocks and minerals, radio carbon dating, hazards of radiation and safety measures

Practical

4. Estimation of Cu in brass.
5. Estimation of Cr and Mn in Steel

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively in December)

Core Course 7 : Organic Chemistry-III

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.SanjoyMondal

Unit 2:

1. Carbonyl and Related Compounds
2. Exploitation of acidity of α -H of C=O
3. Aldol, Friedel-Crafts, Michael, Knoevenagel, Cannizzaro, Benzoin condensation and Dieckmann condensation
4. Nucleophilic addition to α,β -unsaturated carbonyl system
5. Substitution at sp^2 carbon (C=O system)
6. Organometallics:

Practical

1. Melting point
2. Preparation of one derivative

Internal Assessment: 1st Week of December

Theory and Practical Examination: as per notification of B.U. (Tentatively in December)

SEC-1

Basic Analytical Chemistry

Credits: Theory-2, Marks – 50, Theory – 40, Internal Assessment – 10

Name of the teacher: Dr.SanjoyMondal

Unit:2

1. Chromatography
2. Ion-exchange
3. Analysis of cosmetics

Internal Assessment: 1st Week of December

Theory and Practical Examination: as per notification of B.U. (Tentatively in December)

Semester IV**1st Module(July to September)****Core Course 8:Physical Chemistry-III (Theo)**

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Mrs. PallabiAcharyya

Unit-1. Application of Thermodynamics – II

Colligative properties

Phase rule

First order phase transition and Clapeyron equation

Three component systems, water-chloroform-acetic acid system, triangular plots

Binary solutions

Unit-2. Electrical Properties of molecules

Ionic equilibria

Electromotive Force

Concentration cells with and without transference, liquid junction potential

Practical

1. Determination of solubility of sparingly soluble salt in water, in electrolyte with common ions and in neutral electrolyte (using common indicator).

2. Potentiometric titration of Mohr's salt solution against standard $K_2Cr_2O_7$ solution.

3. Determination of K_{sp} for $AgCl$ by potentiometric titration of $AgNO_3$ solution against standard KCl solution

Core Course 9 :Inorganic Chemistry-III

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.Suparna Sadhu

Unit 1: General Principles of Metallurgy

Unit 2: Chemistry of s and p Block Elements

Practical

Complexometric titration

1. $Zn(II)$

2. $Zn(II)$ in a $Zn(II)$ and $Cu(II)$ mixture

3. $Ca(II)$ and $Mg(II)$ in a mixture

4. Hardness of water

Core Course 10: Organic Chemistry-IV

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher: Dr.SanjoyMondal

Unit 1:

1. Nitrogen compounds Reaction

2. Rearrangements Reaction

3. The Logic of Organic Synthesis

Practical

1. Estimation of glucose by titration using Fehling's solution

2. Estimation of vitamin-C (reduced)
3. Estimation of aromatic amine (aniline) by bromination (Bromate-Bromide) method
4. Estimation of phenol by bromination (Bromate-Bromide) method

SEC-2: Pharmaceuticals Chemistry

Credits: Theory-2, Marks – 50, Theory – 40, Internal Assessment – 10

Name of the teacher: Dr.SanjoyMondal

Unit 1: Drugs & Pharmaceuticals

2nd Module (October to December)

Core Course 8: Physical Chemistry-III (Theo)

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Mrs. PallabiAcharyya

Unit-3. Quantum Chemistry

Angular momentum

Qualitative treatment of hydrogen atom and hydrogen-like ions

LCAO and HF-SCF

Practical

4. Effect of ionic strength on the rate of Persulphate – Iodide reaction.

5. Study of phenol-water phase diagram

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

Core Course 10 :Organic Chemistry-IV

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.SanjoyMondal

Unit2:

1. Organic Spectroscopy:

Practical

1. Estimation of formaldehyde (Formalin)

2. Estimation of acetic acid in commercial vinegar

3. Estimation of urea (hypobromite method)

4. Estimation of saponification value of oil/fat/ester.

Internal Assessment: 4th Week of May

Theory and Practical Examination: as per notification of B.U. (Tentatively on June)

Core Course 10 : Molecular Biology

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

SEC-2: Analytical Clinical Biochemistry

Credits: Theory-2, Marks – 50, Theory – 40, Internal Assessment – 10

Name of the teacher:Dr.SanjoyMondal

Unit 2: Fermentation

Internal Assessment : 4th Week of May

Theory and Practical Examination :as per notification of B.U. (Tentatively on June)

Semester V

Ist Module(July to September)

Core Course 11 : Inorganic Chemistry-IV

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.Suparna Sadhu

Unit 1: Coordination Chemistry-II

VB description and its limitations. Elementary Crystal Field Theory: splitting of dn configurations in octahedral, square planar and tetrahedral fields, crystal field stabilization energy (CFSE) in weak and strong fields; pairing energy. Spectrochemical series. Jahn- Teller distortion. Octahedral site stabilization energy (OSSE). Metal-ligand bonding (MO concept, elementary idea), sigma- and pi-bonding in octahedral complexes (qualitative pictorial approach) and their effects on the oxidation states of transitional metals (examples). Magnetism and Colour: Orbital and spin magnetic moments, spin only moments of dn ions and their correlation with effective magnetic moments, including orbital contribution; quenching of magnetic moment: super exchange and antiferromagnetic interactions (elementary idea with examples only); d-d transitions; L-S coupling; qualitative Orgel diagrams for 3d¹ to 3d⁹ ions. Racah parameter. Selection rules for electronic spectral transitions; spectrochemical series of ligands; charge transfer spectra.

Practical

Chromatography of metal ions

Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions:

1. Ni (II) and Co (II)
2. Fe (III) and Al (III).

Spectrophotometry

1. Measurement of 10Dq of 3d metal complexes by spectrophotometric method.
2. Determination of λ_{\max} of KMnO₄ and K₂Cr₂O₇.

Core Course 12: Organic Chemistry-V

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher: SanjoyMondal

Unit 1:

1. Carbocycles and Heterocycles
2. Cyclic Stereochemistry
3. Pericyclic reactions

Practical

1. Chromatographic Separations.

Discipline Specific Elective

DSE 1:Advanced Physical Chemistry (Theo)

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher : Mrs. PallabiAcharyya

Unit 1: Crystal Structure

1. Bravais Lattice and Laws of Crystallography: Types of solid, Bragg's law of diffraction; Laws of crystallography (Haüy's law and Steno's law); Permissible symmetry axes in crystals; Lattice, space lattice, unit cell, crystal planes, Bravais lattice. Packing of uniform hard sphere, close packed arrangements (fcc and hcp); Tetrahedral and octahedral voids.

2. Crystal planes: Distance between consecutive planes [cubic, tetragonal and orthorhombic lattices]; Indexing of planes, Miller indices; calculation of dhkl; Relation between molar mass and unit cell dimension for cubic system; Bragg's law (derivation)

3. Determination of crystal structure: Powder method; Structure of NaCl and KCl crystals

Unit 2: Statistical Thermodynamics

1. Configuration: Macrostates, microstates and configuration; calculation with harmonic oscillator; variation of W with E; equilibrium configuration

2. Boltzmann distribution: Thermodynamic probability, entropy and probability, Boltzmann distribution formula (with derivation); Applications to barometric distribution; Partition function, concept of ensemble - canonical ensemble.

3. Partition function: molecular partition function and thermodynamic properties, Maxwell's speed distribution; Gibbs' paradox.

Practical

Computer Programming based on numerical methods for:

1. Roots of equations: (e.g. volume of van der Waals gas and comparison with ideal gas, pH of a weak acid)

2. Numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations)

DSE- 2: Analytical methods in chemistry

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.Suparna Sadhu

Unit 1: Qualitative and quantitative aspects of analysis

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution, indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Unit2: Optical methods of analysis

1. Origin of spectra, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

2. UV-Visible Spectrophotometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument;

3. Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.

4. Infrared Spectroscopy: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques. Structural illustration through interpretation of data, Effect and importance of isotope substitution.

5. Flame Atomic Absorption and Emission Spectroscopy: Basic principles of instrumentation (choice of source, monochromator, and detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; background correction, sources of chemical interferences and their removal. Techniques for the quantitative estimation of trace level of metal ions from environmental samples.

Unit 3: Thermal methods of analysis

Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Practical

Separation Techniques – Chromatography

1. Separation of mixtures Separation and identification of the monosaccharides in a mixture (glucose & fructose) by paper chromatography. Reporting the R_f values.

2. Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their R_f values.

3. Separation of the active ingredients of plants, flowers and juices by TLC

Spectrophotometry

1. Determination of pK_a values of indicator using spectrophotometry

2. Determination of chemical oxygen demand (COD)

3. Determination of Biological oxygen demand (BOD)

2nd Module (October to December)

Core Course 11 :Inorganic Chemistry-IV

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.Suparna Sadhu

Unit 2:Chemistry of d- and f- block elements

Transition Elements: General comparison of 3d, 4d and 5d elements in term of electronic configuration, oxidation states, redox properties, coordination chemistry.

Lanthanoids and Actinoids: General Comparison on Electronic configuration, oxidation states, colour, spectral and magnetic properties; lanthanide contraction, separation of lanthanides (ion-exchange method only)

Practical

Gravimetry

1. Estimation of nickel (II) using Dimethylglyoxime (DMG).
2. Estimation of copper as CuSCN
3. Estimation of Al (III) by precipitating with oxine and weighing as Al(oxine)₃ (aluminium oxinate)
4. Estimation of chloride.

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively on December)

Core Course 12: Organic Chemistry-V

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher: SanjoyMondal

Unit 5:

1. Carbohydrates
2. Biomolecules
3. Alkaloids and Terpenoids

Practical

Spectroscopic Analysis of Organic Compounds

Internal Assessment: 1st Week of December

Theory and Practical Examination: as per notification of B.U. (Tentatively on December)

DSE 1: Advanced Physical Chemistry (Theo)

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher: Mrs. PallabiAcharyya

Unit 3: Special selected topics

1. Specific heat of solid: Coefficient of thermal expansion, thermal compressibility of solids; Dulong –Petit's law; Perfect Crystal model, Einstein's theory – derivation from partition function, limitations; Debye's T₃ law – analysis at the two extremes (without derivation of T₃ law).

2. 3rd law: Absolute entropy, Planck's law, Calculation of entropy, Nernst heat theorem

3. Polymers: Classification of polymers, nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers; Criteria for synthetic polymer formation; Relationships between functionality, extent of reaction and degree of polymerization; Mechanism and kinetics of step growth and copolymerization; Conducting polymers.

4. Dipole moment and polarizability: Polarizability of atoms and molecules, dielectric constant and polarisation, molar polarisation for polar and non-polar molecules; Clausius-Mosotti 77 equation and Debye equation (both without derivation) and their application; Determination of dipole moments.

Practical

3. Numerical integration (e.g. entropy/ enthalpy change from heat capacity data), probability distributions (gas kinetic theory) and mean values

4. Matrix operations (Application of Gauss-Siedel method in colourimetry)

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively on December)

DSE- 2 :Analytical methods in chemistry

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.Suparna Sadhu

Unit 4: Electroanalytical methods

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pK_a values.

Separation techniques

1. Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation.
2. Technique of extraction: batch, continuous and counter current extractions.
3. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and nonaqueous media.
4. Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange.
5. Development of chromatograms: frontal, elution and displacement methods.
6. Qualitative and quantitative aspects of chromatographic methods of analysis: TLC, LC, GLC, and HPLC.
7. Stereoisomeric separation and analysis: Measurement of optical rotation, calculation of Enantiomeric excess (ee)/ diastereomeric excess (de) ratios and determination of enantiomeric composition using NMR, Chiral solvents and chiral shift reagents. Chiral chromatographic techniques using chiral columns (GC and HPLC).
8. Role of computers in instrumental methods of analysis

Practical

Solvent Extractions

1. To separate a mixture of Ni²⁺ & Fe²⁺ by complexation with DMG and extracting the Ni²⁺- DMG complex in chloroform, and determine its concentration by spectrophotometry.

2. Analysis of soil:

- a. Determination of pH of soil.
 - b. Total soluble salt
 - c. Estimation of calcium, magnesium, phosphate, nitrate
3. Ion exchange: a. Determination of exchange capacity of cation exchange resins and anion exchange resins.

Internal Assessment : 1st Week of December

Theory and Practical Examination : as per notification of B.U. (Tentatively in December)

Semester VI

1st Module(July to September)

Core Course 13 :Inorganic Chemistry-V

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.Suparna Sadhu

Unit 1: Bioinorganic Chemistry

Elements of life: essential and beneficial elements, major, trace and ultratrace elements. Role of metal in biological systems. Metal ion transport across biological membrane. Oxygen transport in biological systems: Haemoglobin, Myoglobin, Hemocyanine and Hemerythrin. Electron transfer proteins: Cytochromes and Ferredoxins. Hydrolytic enzymes: carbonate bicarbonate buffering system, carbonic anhydrase and carboxyanhydrase A. Biological nitrogen fixation, Photosynthesis: Photosystem-I and Photosystem-II. Toxic metal ions and their effects, chelation therapy, Pt and Au complexes as drugs, metal dependent diseases

Unit 2: Reaction Kinetics and Mechanism

Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans- effect and its application in complex synthesis, theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and Kinetic stability, Kinetics of octahedral substitution reactions, Ligand field effects and reaction rates, Mechanism of substitution in octahedral complexes. Unit 3: Linkage, crossing over and chromosome mapping

Practical

Qualitative semimicro analysis Qualitative semimicro analysis of mixtures containing four radicals.

Emphasis should be given to the understanding of the chemistry of different reactions and to assign the most probable composition.

Cation Radicals: Na^+ , K^+ , Ca^{2+} , Sr^{2+} , Ba^{2+} , Al^{3+} , Cr^{2+} , $\text{Mn}^{2+}/\text{Mn}^{4+}$, Fe^{3+} , $\text{Co}^{2+}/\text{Co}^{3+}$, Ni^{2+} , Cu^{2+} , Zn^{2+} , Pb^{2+} , Cd^{2+} , Bi^{3+} , $\text{Sn}^{2+}/\text{Sn}^{4+}$, $\text{As}^{3+}/\text{As}^{5+}$, $\text{Sb}^{3+}/\text{Sb}^{5+}$, NH_4^+ , Mg^{2+} .

Anion Radicals: F^- , Cl^- , Br^- , BrO_3^- , I^- , IO_3^- , SCN^- , S^{2-} , SO_4^{2-} , NO_3^- , NO_2^- , PO_4^{3-} , AsO_4^{3-} , BO_3^{3-} , $\text{CrO}_4^{2-}/\text{Cr}_2\text{O}_7^{2-}$, $\text{Fe}(\text{CN})_6^{4-}$, $\text{Fe}(\text{CN})_6^{3-}$.

Insoluble Materials: $\text{Al}_2\text{O}_3(\text{ig})$, $\text{Fe}_2\text{O}_3(\text{ig})$, $\text{Cr}_2\text{O}_3(\text{ig})$, SnO_2 , SrSO_4 , BaSO_4 , CaF_2 , PbSO_4

Core Course 14: Physical Chemistry-IV (Theo)

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Mrs. Pallabi Acharyya

Unit 1: Molecular Spectroscopy

1. Interaction of electromagnetic radiation with molecules and various types of spectra; BornOppenheimer approximation

2. Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution

3. Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration.

4. Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion 5. Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling and high resolution spectra

Unit 2:Photochemistry

1. Lambert-Beer's law: Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients; Laws of photochemistry, StarkEinstein law of photochemical equivalence quantum yield, actinometry, examples of low and high quantum yields

2. Photochemical Processes: Potential energy curves (diatomic molecules), Frank-Condon principle and vibrational structure of electronic spectra; Bond dissociation and principle of determination of dissociation energy (ground state); Decay of excited states by radiative and non-radiative paths; Pre-dissociation; Fluorescence and phosphorescence, Jablonski diagram;

3. Rate of Photochemical processes: Photochemical equilibrium and the differential rate of photochemical reactions, Photostationary state; HI decomposition, $\text{H}_2\text{-Br}_2$ reaction, dimerisation of anthracene; photosensitised reactions, quenching; Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence

Practical

1. Determination of surface tension of a liquid using Stalagmometer
2. Determination of CMC from surface tension measurements.
- 3.

DSE-3 :Polymer Chemistry

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.SanjoyMondal

Unit 1:

1. Introduction and history of polymeric materials
2. Functionality and its importance
3. Kinetics of Polymerization

Practical

1. Polymer Synthesis

DSE-4 :Inorganic materials of industrial importance

Or

Dissertation followed by power point presentation

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.Suparna Sadhu

Unit 1: Silicate Industries

1. Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

2. Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

3. Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

Unit2: Fertilizers

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

Unit3: Surface Coatings

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing

Field trip and Practical

1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Determination of composition of dolomite (by complexometric titration).

2nd Module (October to December)

Core Course 13 : Inorganic Chemistry-V

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.Suparna Sadhu

Unit 3. Organometallic Chemistry

Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. 18-electron and 16-electron rules (pictorial MO approach). Applications of 18-electron rule to metal carbonyls, nitrosyls, cyanides. General methods of preparation of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls. π -acceptor properties of CO, synergic effect and use of IR data to explain extent of back bonding. Zeise's salt: Preparation, structure, evidences of synergic effect. Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation). Reactions of organometallic complexes: substitution, oxidative addition, reductive elimination and insertion reactions.

Unit4: Catalysis by Organometallic Compounds

Study of the following industrial processes 1. Alkene hydrogenation (Wilkinson's Catalyst) 2. Hydroformylation 3. Wacker Process 4. Synthetic gasoline (Fischer Tropsch reaction) 5. Ziegler-Natta catalysis for olefin polymerization.

Practical

Qualitative semimicro analysis

Qualitative semimicro analysis of mixtures containing **unknown** four radicals (Analysis of minimum 10 unknown samples)

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

Core Course 14: Physical Chemistry-IV (Theo)

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Mrs. PallabiAcharyya

Unit 4: Surface phenomenon

1. Surface tension and energy: Surface tension, surface energy, excess pressure, capillary rise and surface tension; Work of cohesion and adhesion, spreading of liquid over other surfaces; Vapour pressure over curved surface; Temperature dependence of surface tension

2. Adsorption: Physical and chemical adsorption; Freundlich and Langmuir adsorption isotherms; multilayer adsorption and BET isotherm (no derivation required); Gibbs adsorption isotherm and surface excess; Heterogenous catalysis (single reactant); Zero order and fractional order reactions;

3. Colloids: Lyophobic and lyophilic sols, Origin of charge and stability of lyophobic colloids, Coagulation and Schultz-Hardy rule, Zeta potential and Stern double layer (qualitative idea), Tyndall effect; Electrokinetic phenomena (qualitative idea only); Determination of Avogadro number by Perrin's method; Stability of colloids and zeta potential; Micelle formation.

Practical

3. Verification of Beer and Lambert's Law for KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ solution.

4. Determination of pH of unknown buffer, spectrophotometrically

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

DSE-3 :Polymer Chemistry

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.SanjoyMondal

Unit 4:

1. Determination of molecular weight of polymers
2. Glass transition temperature (T_g) and determination of T_g
3. Polymer Solution
4. Properties of Polymer

Practical

1. Polymer Characterization
2. Polymer Analysis

Internal Assessment: 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

DSE 4 :Inorganic materials of industrial importance

Or

Dissertation followed by power point presentation

Credits: Theory-4, Practical-2, Marks – 75, Theory – 40, Practical – 20, Internal Assessment – 10, Attendance-05

Name of the teacher :Dr.Suparna Sadhu

Unit 4:Batteries

Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

Unit 5: Alloys

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (Ar and heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

Unit 6: Catalysis

General principles and properties of catalysts, homogenous catalysis (Hydroformylation, Wacker (Smidt) Process, Monsanto acetic acid process, Wilkinson's catalyst), and heterogenous catalysis (Zeigler-Natta Polymerizations, water gas reaction), catalytic steps and their industrial applications, Deactivation or regeneration of catalysts. Phase transfer catalysts, application of zeolites as catalysts.

Unit 7: Chemical explosives

Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants..

Field trip and Practical

5. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.

6. Analysis of Cement.

7. Preparation of pigment (zinc oxide).

Internal Assessment : 4th Week of May

Theory and Practical Examination : as per notification of B.U. (Tentatively on June)

Counselling Programme – Final week of June- General outline on the admission and scope of higher education and related jobs