Govt. Zirtiri Residential Science College – Aizawl, Mizoram
Department of Chemistry
Program Outcomes and Course Outcomes
Under Graduate (Honours) program in B.Sc. Chemistry

PROGRAM OUTCOME

- To understand the basic facts and concepts of Chemistry
- To understand the importance of Chemistry in daily life.
- To develop a better understanding and reasoning of facts about chemistry and chemicals.
- To skill-up for basic analytical experimental tools.
- To skill-up for various laboratory techniques used in chemical industries.
- To gain knowledge about various spectrometric and analytical methods.
- To acquire knowledge and skill to undertake higher studies in chemistry and related areas that can be helpful for employment/self-employment.

COURSE OUTCOME

Theory Papers
SEM-I
Paper: CHEM/I/EC/01: INORGANIC CHEMISTRY – I

After completion of this course the students will learn to:

Describe the basics of atomic structures using de-Broglie's relation and Heisenberg uncertainty principle.

Explain Schrodinger wave equation & atomic orbitals in terms of quantum numbers.

Aufbau Principle, Pauli's Exclusion Principle & Hund's rule

Explain effective nuclear charge and shielding effect & the shapes of s, p and d-orbitals.

Summarize the general features and properties of the long form of periodic table.

Interpret periodic trends in certain properties such as atomic radii, ionization energy, electron affinity & electronegativity.

Implement the electronic concept of oxidation, reduction and oxidation number and its related problems.

Describe basic concept of different types of bonds, ionic character, polarity in covalent compounds and explain bond moment and dipole moment.

Predict the orientation of hybrid orbitals, concepts of hybridization and VSEPR theory with applications to simple molecules and ions

Hydrogen bonding and its effect on melting points and boiling points.

Werner's theory of coordination compounds and IUPAC nomenclature of coordination compounds.

Describe EAN, chelate effect, ligands.

Stereochemistry of complex compounds and knowledge of isomerism.

Simple laws of radiochemistry such as units of radioactivity, group displacement law, radioactive disintegration theory, radioactive equilibrium, artificial radioactivity, halflife and average-life period and solve its related problems.
Explain neutron-proton ratio in a nucleus and their implications.
Packing fraction, mass defect and nuclear binding energy.

SEM-II
Paper: CHEM/II/EC/03: ORGANIC CHEMISTRY – I
After completion of this course the students will learn
CO1. Explain the importance of electron-displacement effects in reaction mechanisms, electrophiles and nucleophiles and the stability of reaction intermediates. Hydrogen bonding and its effect on melting points and boiling points, molecular orbital picture of benzene, resonance energy, Huckel rule and its application. Hhalogenation, the electrophilic and nucleophilic substitution in aromatic halogen compounds.
Analyze the structure and chemical reactivity of carbonyl group and describe the nucleophilic additions and addition-elimination reaction mechanism of carbonyl compound. Explain the acidic character and physical properties of phenol and the chemical reactions.
Chemical reactivity and methods of preparation of carboxylic acids and their derivatives. Describe the basicity, substituent effects on basicity, chemical reactivity of aliphatic and aromatic amines. Nucleophile, ambident nucleophile, SN1, SN2 and SNi and the factors affecting substitution reactions, mechanism and stereochemistry of substitution reactions. Application of Saytzeff's and Hofmann's rule.

SEM-III
Paper: CHEM/III/EC/05: PHYSICAL CHEMISTRY – I
After completion of this course the students will learn to
Explain the kinetic molecular model of a gas and Ideal behaviour and
Derivation of kinetic gas equation (KGE) and its dependence on pressure for different gases.
Van der Waal's equation of state and critical constants
Law of Corresponding states & Boyle temperature.
liquid crystals, the vacancy theory of liquid & free volume in liquid.
physical properties of liquids, effect of temperature on surface tension & viscosity.
Define refraction index, specific refraction & molar refraction.
Prepare colloids and classify them & explain Peptization, Bredig's and condensation methods.
Explain the optical properties of colloids-Tyndall effect, the origin of charge on colloidal particles, protective colloids and gold number.
Distinguish between physisorption & chemisorptions; and explain molar enthalpy of adsorption.
Differentiate Langmuir, Freundlich & Gibbs adsorption isotherms. Explain the dissociation equilibria of weak electrolytes, dissociation constant of weak acids (Ka), ionic product of water (Kw) and hydrolysis constant (Kh).
Explain hydrogen ion concentration and pH scale, buffer solutions & buffer activity, Henderson - Hasselbach equations for acidic & basic buffers. Ka, Kw and Kh, the hydrolysis

constant for salts of i) strong acid and weak base, ii) weak acid and strong base and iii) weak acid and weak base.
State the 2nd law of thermodynamics & explain the limitations of the first law and the need of the second law.
Explain Carnot's cycle and the efficiency of Carnot's engine.
Explain the concept of entropy, entropy change for an ideal gas with (i) T & V (ii) T & P & (iii) Entropy change for reversible and irreversible processes. Discuss the relationship between entropy (S), probability (W) and solve the related problem

SEM-IV
Paper: CHEM/IV/EC/07: ANALYTICAL CHEMISTRY – I
After completion of this course the students will learn
Explain the storage and handling of chemicals and acids, ethers, toxic and poisonous chemicals.
Explain antidotes, threshold vapour concentration and first aid procedure.
Illustrate different methods and techniques of heating, stirring and filtration.
Define common ion effect and apply solubility product and common ion effect in analytical chemistry.
Determine the interfering anions, their removal and group separation. Explain different classical theories of distillation, fractional distillation, steam distillation, sublimation, zone refining, the separation of mixtures by Craig method.
Describe solvent extraction, recovery and enrichment factors including liquid-liquid extraction, successive extractions, application of high molecular mass amines, dithiocarbamates and crown ethers in extraction.
Evaluate significant figures, rounding off of numerical expressions and explain different types of errors, minimization of errors, propagation of determinate errors.
Distinguish between accuracy and precision and determine the methods of their expression and rejection of data.
Provide statistical treatment of analytical data, uncertainties involve in addition, subtraction, multiplication and division.
Determine the confidence limits and intervals, test of significance like F-test and t-test.
Define different terms commonly used in volumetric titrimetry (analyte, titrant, titration, equivalence point, end point, indicator), primary standard, secondary standard & concentrations of standard solutions (normality, molarity, ppm).
Conduct acid-base titration, redox titration, iodimetric and iodometric titration.
Explain the theory of acid-base indicators, the theory of precipitation and purification of precipitates, co-precipitation, post-precipitation, fractional-precipitation.
Describe the chemistry of separation and estimation of ions (iron-calcium, calcium-barium and iron-copper).
Demonstrate inorganic analysis by applying the following organic reagents like Oxine, 1-nitroso-2-napthol, cupferron, dithiazone, dimethylglyoxime and rhodamine-B

SEM-V
Paper : CHEM/V/CC/09: INORGANIC CHEMISTRY – II

After completion of this course the students will learn
Summarize the general characteristics and packing of ions in ionic crystals.
Explain different types of interstitial sites, limiting radius ratio values for different interstitial sites, radius ratio rules to determine the shape the of ionic crystals.
Describe the lattice energy and factors affecting the magnitude of lattice energy.
Elucidate Born-Haber cycle and its application.
Define solvation energy and determine the solubility of ionic solids.
Discuss different types of defects in crystals and their consequences and explain n-type and ptype semiconductors.
Explain the conditions required for combination of atomic orbitals and illustrate pictorial presentation of atomic orbital to form various molecular orbital.
Draw molecular orbital diagrams of simple homonuclear (H2, He2, O2 and N2) and heteronuclear (CO and NO) diatomic molecules and their ions.
Explain different weak chemical forces and its effect on melting and boiling points.
Describe the preparation, properties, structure and uses of hydrides and carbides (ionic and covalent) of s- and p-block elements.
Explain catenation, inert pair effect and relative stability of different oxidation states of pblock elements.
Describe oxides and oxoacids of nitrogen and peroxo-acids of sulphur. Discuss different types, structures and bonding of interhalogen & pseudohalogens compounds.
Describe fractionation of liquid air for isolation and separation of the noble gases, the preparation, structure and bonding of XeF2, XeF4 and XeF6, clathrates.
Explain brief review of Bronsted – Lowry concept, Lewis concept and solvent system concept of acids and bases.
Classify solvents and explain the importance of non-aqueous solvents. Explain different reaction in liquid ammonia, the action of liquid ammonia on alkali metals and alkaline earth metals.
Describe symmetry operations, symmetry elements and symmetry point groups of different compound and specify rules and conditions for a molecule to form group, group multiplication table, sub-group, class and order of a group.
Generalize the group trends of transition metals with special reference to the electronic configuration, colour, oxidation states, reducing properties, magnetic properties and ability to form complexes.
Differentiate between the first, second and third transition series.
Apply valence bond theory in inner and outer orbital complexes of coordination compounds.
Explain crystal field theory, CFSE in weak and strong fields & summarize the factors influencing the magnitude of crystal field splitting.
Apply CFS in octahedral, tetrahedral and square planar geometry

Paper: CHEM/V/CC/11: ORGANIC CHEMISTRY – II

After completion of this course the students will learn
Explain the concept and types of isomerism, illustrate E & Z system of nomenclature, geometrical isomerism in oximes and alicyclic compounds.

Discuss elements of symmetry, molecular chirality, enantiomers and its properties and resolution, stereogenic centre, optical activity, chiral and achiral molecules with two stereogenic centres, diastereo isomers, meso-compounds.
Explain inversion & retention of configurations, racemization, relative & absolute configuration, sequence rules, D & L and R & S system of nomenclature.
Explain conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, mono-substituted and di-substituted cyclohexane.
Distinguish between configuration & conformation, Newman projection and sawhorse formulae, Fischer and flying wedge formulae.
Describe the preparation and electrophilic substitution reactions of heterocyclic-I compound.
Describe the structure, synthesis and reactions of pyridine, compare the basicity of pyrrole/pyridine, pyrrole/pyrrolidine and pyridine/piperidine.
Describe the preparation of heterocyclic-II compound with special reference to Fischer indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis.
Explain active methylene compounds with examples, tautomerism and distinguish between tauto-merism and resonance (Keto-enol tautomerism).
Explain Cannizzaro's reaction, the formation of enolates, aldol condensation, Perkin-reaction, benzoin condensation, Clemmensen and Wolff-Kishner reductions. -hydrogen in carbonyl compounds, the formation of carbon-carbon bond,α
. Discuss acidity of electrophilic and nucleophilic carbon species.
Explain the formation and acid-assisted cleavage of acetals and ketals, acid-assisted reaction and base- assisted condensation reactions.
Describe the mechanisms of formation and hydrolysis of esters and amides (acyclic and cyclic).
CO14. Explain different reaction involving carbocation rearrangement.

Paper: CHEM/V/CC/13: PHYSICAL CHEMISTRY – II

After completion of this course the students will learn
. Derive Maxwell's distribution law of molecular velocities & evaluate the average, root mean square (rms), most probable velocities & average kinetic energy (KE) from Maxwell's law.
Describe KE as a function of temperature, degrees of freedom and the law of equipartition of energy.
Define space lattice, unit cell, laws of crystallography, laws of constancy of interfacial angles, rational indices & miller indices, laws of symmetry, symmetry elements in crystals, seven crystal systems, Bravais lattices & X-ray diffraction by crystals.
Derive Bragg's equation & analyse the experimental method of crystal by Bragg's X-ray spectrometer and the Debye-Scherrer powder method.
Explain the concepts of rate, order & molecularity of reaction, the effect of temperature on reaction rate and the temperature coefficient of a reaction.
Derive Arrhenius equation & explain the concept of activation energy, collision theory & absolute reaction rate theory.
Explain turn over number, the types and characteristics of catalysis, enzyme catalysis & derive Michaelis–Menten equation.

State the third law of thermodynamics & the Nernst Heat Theorem.
Explain the concept of residual entropy & calculate absolute entropy from heat capacity data (up to Debye T3 Law).
Describe Gibb's (G) and Helmholz (A) energy, the variation of G & A with P, V, & T, derive Gibb's - Helmholz equation.
Explain the concept of partial molar properties and partial molar energy (chemical potential).
. Derive Gibbs – Duhem equation & illustrate the variation of chemical potential with T & P.
Explain electrical conductance, specific, equivalent and molar conductivity, variation of conductance with dilution for weak and strong electrolytes
Describe Kohlrausch's law of independent migration of ions, Arrhenius theory of electrolytic dissociation, Ostwald's dilution law & ionic strength, Debye – Huckel – Onsager equation for strong electrolytes.
Explicate asymmetry effect, electrophoretic effect, drift velocity, ionic mobility & transport number.
Determine transports number by Hittorf's and moving boundary method.

Paper: CHEM/V/CC/15(B): INDUSTRIAL CHEMISTRY(Optional Paper)
After completion of this course the students will learn
Define and explain essential nutrients (N, P, K), their role in plants, the important properties and uses of nitrogenous fertilizers, phosphatic fertilizers, potash fertilizers & mixed fertilizers like biofertilizers.
List the composition of Portland cements, essential raw materials used for the manufacture (through wet process) and setting of cement.
Explain the raw materials for glass manufacture, the manufacture of ordinary glass & characterize various glasses.
Explain fermentation process & mode of operation fermentation process, the application of fermentation-microbial biomass, microbial enzyme.
Explain transformation process, recombinant products, the genetic improvement of product formation-mutation.
Illustrate assurance of food safety, food chemistry-carbohydrates, proteins, lipids, minor components of foods, water in foods, food processing-fundamental of fluid flow, food preservation, food process and flowcharts, refrigerated transport of fruits and vegetables.
Explain curing, preservation and tanning of hides and skins, process of dehairing and dyeing, treatment of tannery effluents.
Give detail about the origin of explosive, the preparation and chemistry of lead azide, nitroglycerine, nitrocellulose, TNT, Dynamite, cordite, picric acid, gunpowder & rocket propellants.
Give detail about the origin, different types and economics importance of coal, analyse the composition of coal.
Explain coal gasification, carbonisation, coal-tar based chemicals manufacture & coal mines in India.
Give detail about the origin of petroleum, refining, cracking, reforming, knocking, octane number, synthetic gas, synthetic petrol, large scale production of fuel gases, storage & hazards.

Explain the uses of coal gas, water gas, producer gas and oil gas.
CO13.Explain the important industrial polymers, preparation and its application.
Assess the role of textile designers, timing in the textile industry, designer's projection & adhesives.
Discuss colour-considerations in textile design techniques of forming colour combinations, changing colour looks, presenting of colour combinations.

SEM-VI

Paper: CHEM/VI/CC/16: INORGANIC CHEMISTRY – III

After completion of this course the students will learn
Define organometallic compounds & explain the preparation of organometallic compounds, the properties, applications & its classification. -metal-alkenyl complexes, the preparation, structure andπ
Give a brief account of bonding in -acceptor property of CO and backπbonding of mononuclear and dinuclear metal carbonyls, the bonding in metal carbonyls.
Give details about structural aspects of myoglobin and haemoglobin and their role in biological systems.
Describe metalloenzymes of zinc, their characteristics and functions.
Explain the role of alkali metals (Na^+ and K^+) and alkaline earth metals (Mg^{2+} and Ca^{2+}) in biological process.
Summarize the general properties and types of inorganic polymers, compare inorganic polymers with organic polymers.
Explain the synthesis, structural aspects and application of Silicones and polyphosphonitrilic chlorides.
Explain the electronic configuration, oxidation states, separation of lanthanides by ion exchange method and lanthanide contraction.
Characterize the colour and magnetic properties of M^{3+} ions and explain its ability of complex formation.
Explain the electronic configuration, oxidation states, colour of actinides, its ability of complex formation & compare lanthanides and actinides.
Explain different terms and meaning involved in magneto-chemistry, the magnetic behaviour of simple inorganic complexes.
State Curie's law, Curie-Weiss law and Bohr magneton.
Determine the variation of magnetic susceptibility with temperature for paramagnetic, ferromagnetic and antiferromagnetic substances.
Explain Infrared spectroscopy and its application in metal-halogen bonds (terminal and bridged) and metal-amine complexes.
Determine the structure of different chemical compounds using Raman spectroscopy.

Paper: CHEM/VI/CC/18: ORGANIC CHEMISTRY – III

After completion of this course the students will learn
Explain molecular and photochemical energy, excitation of molecules, Franck-Condon Principle, dissipation of energy and Jablonski-diagram.

Depict various processes occurring in the excited state, singlet-triplet states & explain photosensitization, quenching and quantum yield.
Give qualitative description of fluorescence, phosphorescence, non-radiative processes (Internal conversion & inter system crossing).
CO4. Explain the photochemical reactions of carbonyl compounds, photoreduction, paterno-Buchi reaction, Norrish type-I and Norrish type-II cleavages.
Define pericyclic reactions & explain the stereochemistry of electrocyclic reaction, conrotatory – dis-rotatory ring closure and ring opening.
Describe Woodward-Hofmann's rule for electrocyclic reactions, Frontier molecular orbital theory.
Explain dienes and dienophiles, supra-supra, antara-antara modes of cycloadditions.
Discuss the nomenclature, structural features, formation and chemical reactions of organo-zinc compounds, organo-lithium compounds & organo-sulphur compounds
Give detail about synthetic applications of Grignard's reagent in the synthesis of alkanes, alcohols, acids, aldehydes, ketones and amines with mechanism.
Explain the principles of green chemistry, green preparation (Sonication Reaction): Butyraldehyde, 2-Chloro-N-aryl anthranilic acid, green reactions with mechanism in Aldol condensation, Baeyer – Villager oxidation with migratory aptitude, Michael addition, Diels-Alder reaction & Wittig reaction.
Explain microwave assisted organic reactions in water: Mannich reaction, Hofmann elimination.
Explain organic synthesis using biocatalysts: biochemical (Microbial) oxidation and reduction.
Explain the basic principle of Mass spectrometry, types of ion produced in mass spectrometer, molecular ion peak, base-peak and metastable ion.
Determine the molecular weight of organic compounds with Mass spectrometry.
Give detail about the basic principle of NMR spectroscopy, chemical shifts, shielding & deshielding of protons, chemically and magnetically equivalent protons, NMR peak area and proton coupling.
Give details about chemical shifts and coupling constants for ethyl bromide, ethanol, acetaldehyde, 1,1,2 – tribromo ethane, ethyl acetate, toluene and acetophenone

Paper: CHEM/VI/CC/20: PHYSICAL CHEMISTRY – III

After completion of this course the students will learn to
Differentiate between thermal & photochemical reactions, explain photochemical reactions involving dissociation of HI, CH3CHO, photo-sensitized reaction involving photosensitizes.
State Grotthus-Draper law, Beer-Lambert's Law; Stark-Einstein law of photochemical equivalence, quantum yield, quenching & chemiluminescence.
Explain black body radiation, Planck's radiation law, Photoelectric effect & heat capacity of solids.
State and explain postulates of quantum mechanics.
Derive Schrodinger wave-equation and apply the equation to i) free particles ii) particle in a one dimensional (1D) box & explain Schrodinger wave-equation for H-atom and its separation to three equations.

Explain quantization of energy levels and zero point energy.
Point out the limitations of classical thermodynamics.
Explain the concept of distribution of energy & thermodynamic probability, Boltzmann distribution law, molecular partition function and its physical significance.
Describe the relationship between thermodynamic functions and partition functions and calculate the translational, rotational, vibrational and electronic partition functions
Describe the interaction of electromagnetic radiation with molecules and various types of spectra.
State and explain Born – Oppenheimer approximation and Frank-Condon Principle.
Illustrate qualitative σ, π & n MOs (molecular orbitals), their relative energy levels and respective transitions & give the examples of conjugated molecules.
Explain the fate of electronically excited states-radiative and non-radiative decay, compare fluorescence and phosphorescence.
Describe rotational energy levels of diatomic molecules (rigid rotor) and its selection rule.
Determine the relative intensity of rotational spectral lines, bond-length, vibrational energy levels of diatomic molecules (one dimensional harmonic oscillator) and its selection rules.
Evaluate force constant from fundamental frequencies, anharmonicity and Morse potential, dissociation energy, overtones, and hot bands.
Describe classical theory of Raman effect and its selection rules, the effect of nuclear spins, stokes and anti-stokes lines, mutual exclusion rule. Define chemical cells, reversible and irreversible cells with examples, electromotive force of a cell and its measurement.
Derive Nernst equation.
Describe standard electrode (reduction) potential and its application to different kinds of halfcells.
Determine, by applying EMF measurements in (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone and glass electrodes.
Describe concentration cells with and without transference, liquid junction potential, the activity coefficients and transference numbers.
Discuss potentiometric titrations (acid-base, redox titrations) quantitatively.

Paper: CHEM/VI/CC/22(B): NATURAL PRODUCTS (Optional Paper)

After completion of this course the students will learn
Terpenes & their classification.
Give detail about isolation and detection alkaloids.
Explain Hoffmann degradation.
Give detail about survey of different methods - Ultraviolet – Visible spectroscopy, Infrared Spectroscopy, NMR Spectroscopy, Mass Spectroscopy for structure determination.
Explain the absolute stereochemistry of morphine, benzyl isoquinoline alkaloids, rotenoids, abietic acid, menthol and vinblastine, the conformation of naturally occurring germacranolides.
Discuss the rearrangement reaction of morphine, The Wesley – Moser rearrangement, molecular yoga, reactions of papverine and Nametkin rearrangement.
Explain insect pheromones, plant - insect interactions and defensive secretion of insects.

Give detail about the synthesis of a semiochemical and a chiral marine natural product.
Explain the stereoselective synthesis of reserpine and a paraconic acid.
Explain biosynthesis of some benzylisoquinoline alkaloids, isoflavones and its transformation and reticuline to morphine.

Practical Papers

SEM-I

Paper: CHEM/I/EC/02: INORGANIC CHEMISTRY – I

After completion of this course the students will learn to
Identify the unknown radicals/ions from a mixture of inorganic compounds.
Prepare standard solutions of different molarity/normality of titrants.
Estimate carbonate and hydroxide present together in mixture.
Estimate carbonate and bicarbonate present together in a mixture

SEM-II

Paper: CHEM/II/EC/04: ORGANIC CHEMISTRY – I

After completion of this course the students will learn
Analysis of the unknown organic compounds containing functional group qualitatively.
Detect different elements (N, Cl, Br, I, S).
Detect different functional group (COOH, NH2, NO2, OH (phenolic) & CO (carbonyl group) and amide).
Prepare different derivatives.

SEM-III

Paper: CHEM/III/EC/06: PHYSICAL CHEMISTRY – I

After completion of this course the students will learn
Determination of surface tension by Drop number method.
Determination of coefficient of viscosity by Oswald's viscometer of ethanol – water system.
Determination of water equivalent of a calorimeter.
Determination of heat of neutralization of a strong acid with strong base.
Explain the heat of dilution of H2SO4 and determine the strength of the unknown acid

SEM-IV

Paper: CHEM/IV/EC/08: ANALYTICAL CHEMISTRY – I

After completion of this course the students will learn
Determine the indicator constant - colorimetry.
Application of Beer's Law – To determine the concentration of solution by colorimetry.
Determine the pH of a given solution using glass electrode.
Determine dissociation constants of weak acid, base.
Determine the pH of a given buffer.
Titrate the HCl solution against NaOH solution potentiometrically and to determine the concentration of HCl in a solution.
Titrate the solution of Fe2+ salt against Cr2O72- and to determine the formal redox potential of Fe2+ reversible to Fe3+ system.

Estimate the strength of I2 solution using sodium thiosulphate solution (Iodimetrically). Estimation of Cu(II) and/or K2Cr2O7 using sodium thiosulphate (Iodometrically). Estimation of the percentage of available chlorine in bleaching powder (Iodometrically).

SEM-V

Paper: CHEM/V/CC/10: INORGANIC CHEMISTRY – II

After completion of this course the students will learn

Preparation of different inorganic compounds.

Quantitative estimation of Nickel (II) using Dimethylglyoxime (Gravimetrically).

Quantitative estimation of Sulphate or/and Barium (Gravimetrically).

Quantitative estimation of Iron as Fe2O3 (Gravimetrically).

Paper: CHEM/V/CC/12: ORGANIC CHEMISTRY – II

After completion of this course the students will learn

Organic preparation of – i) Phthalimide ii) m-Dinitro benzene iii) Picric acid iv) Benzoic acid v) Aspirin from methyl salicylate

Separation of Binary organic mixtures based on acid-base concept

Determination of melting points.

Paper: CHEM/V/CC/14: PHYSICAL CHEMISTRY – II

After completion of this course the students will learn

Determination of the solubility of a given salt (BaCl2) at two temperatures (60oC and 40oC) and to determine the heat of solution.

Determination the solubility of benzoic acid (an organic acid) at two temperatures (50oC and room temperature); and then to determine the heat of solution of that solute.

Determination the strength of the given ferrous sulphate solution potentiometrically.

Determination of the velocity constant of the hydrolysis of methyl acetate, catalysed by an acid.

Determination of the strength of hydrochloric acid solution (approx. N/10) by titration against standard sodium hydroxide solution conductometrically (use oxalic acid for the standardization of sodium hydroxide conductometrically).

acid-alkali Titration using potentiometer.

Determination of the strength of a halide solution potentiometrically

SEM-VI

Paper: CHEM/VI/CC/17: INORGANIC CHEMISTRY – III

After completion of this course the students will learn

Estimation (by complexometric titration) of Mg2+ and Ca2+ with EDTA. Estimation of temporary, permanent and total hardness of water samples. (complexometric titration).

Volumetric Estimations (Argentometry), Oxidation-reduction titrimetry with KMnO4 and K2Cr2O7 solutions.

Paper: CHEM/VI/CC/19: ORGANIC CHEMISTRY – III

After completion of this course the students will learn

Determination of λmax values for 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4)
The pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$
Determination the concentration of the given organic compound using UV-Vis spectrophotometer.
Biginelli condensation: Synthesis of 3, 4-dihydropyrimidin-2-ones using acid catalysts.
Hantzsch ester synthesis: synthesis of 1, 4-dihydropyridine.
Extraction of essential oils from plants (eucalyptus, Ageratina adenophora, etc.) using Clevenger apparatus.
Extraction and isolation of casein and lactose from milk
Extraction of caffeine from tea leaves

Paper: CHEM/VI/CC/21: PHYSICAL CHEMISTRY – III
After completion of this course the students will learn
Determination of the partition coefficient of Iodine between CCl_4 and water.
Determination of the partition coefficient of Iodine between Kerosene and water.
Determination of the partition coefficient of benzoic acid between benzene and water.
Veriffication of Beer-Lambert's law using copper sulphate or $K_2Cr_2O_7$ solution Colorimetrically or Spectrometrically
Determination of the adsorption of oxalic acid on activated charcoal and verification of Freundlich's adsorption isotherm.