

Y.S. Palpara Mahavidyalaya
Programme Specific Outcome
CHEMISTRY (General)

Upon successful completion of this course

- a) Students will be able to gather the fundamental scientific principles in the different fields of chemistry (Organic, Inorganic, Physical and analytical Chemistry).
- b) Students will be able to a lot knowledge about different chemical synthesis and reaction and they also learn for safe use and handling of chemicals.
- c) Through proper learning of full UG course in chemistry, a student can get various opportunities for their future work in interdisciplinary field like biochemistry, nano fields, polymer science and industrial chemistry.
- d) Apply for different technical course related to chemistry.
- e) Apply for job in different chemical company.

Y.S. Palpara Mahavidyalaya
Course outcome
CHEMISTRY (General)

Semester-I

DSC-1A(CC-1): Atomic Structure, Bonding, general organic chemistry & aliphatic hydrocarbons

Theory (DSC1AT)

Section A: Inorganic Chemistry-1

a. Atomic Structure

To know about fundamentals of Bohr's theory, de Broglie's relation, Heisenberg Uncertainty principle, hydrogen atom spectra, time independent Schrodinger equation and the concept of atomic orbitals

b. Chemical Bonding and Molecular Structure

To know about the general characteristics of ionic bonding, Born-Landé equation, Born-Haber cycle and its applications, Fajan's rules and ionic

character in covalent compounds.

To know about the fundamentals of covalent bonding, VB theory, VSEPR theory, MO theory and LCAO approach.

Section B: Organic Chemistry-1

c. **Fundamentals of Organic Chemistry**

To know about inductive Effect, electromeric effect, resonance, hyperconjugation and the fundamentals of nucleophiles and electrophiles and aromaticity

d. **Stereochemistry**

To know about conformation, interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations, concept of chirality, geometrical and optical isomers, CIP Rules, R/ S and E / Z nomenclature

e. **Aliphatic Hydrocarbons**

To know about the preparation and reactions of common alkanes, alkenes and alkynes

Practical (DSC1AP)

- Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
- Estimation of oxalic acid by titrating it with KMnO_4 ,
- Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .
- Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.
- Estimation of Cu (II) ions iodometrically using $\text{Na}_2\text{S}_2\text{O}_3$.
- Detection of special elements in organic compounds.
- To separate mixtures by chromatography and measurement of R_f values.

Semester-II

DSC-1B(CC-2): Chemical Energetics, Equilibria & Functional Organic Chemistry

Theory (DSC1BT)

Section A: Physical Chemistry-1

a. **Chemical Energetic**

To know about the laws of thermodynamics, fundamentals of thermochemistry, Kirchhoff's equation, statement of third law of thermodynamics and calculation of absolute entropies of substances

b. **Chemical Equilibrium**

To know about free energy change of a chemical reaction, thermodynamic derivation of the law of chemical Equilibrium, distinction between ΔG and ΔG° , LeChatelier's principle. relationships between K_p , K_c and K_x .

c. **Ionic Equilibria**

To know about strong and weak electrolytes, ionization constant and ionic product of water, ionization of weak acids and bases, pH scale, common ion

effect, salt hydrolysis and calculation of hydrolysis constant, degree of hydrolysis and pH for different salts, Buffer solutions, solubility and solubility product of sparingly soluble salts.

Section B: Organic Chemistry-2

- d. To know about preparation and reactions of aromatic hydrocarbons, alkyl and aryl halides, alcohols, phenols and ethers, and aliphatic and aromatic ethers.

Practical (DSC1BP)

- a. Determination of heat capacity of calorimeter for different volumes.
- b. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
- c. Determination of enthalpy of ionization of acetic acid.
- d. Determination of integral enthalpy of solution of salts (KNO_3 , NH_4Cl).
- e. Determination of enthalpy of hydration of copper sulphate.
- f. Study of the solubility of benzoic acid in water and determination of ΔH .
- g. Measurement of pH of aerated drinks, fruit juices, shampoos and soaps.
- h. Preparation and measurement of acidic and alkaline buffer solutions.
- i. Purification of organic compounds by crystallization from water and alcohol and distillation.
- j. Determination of purity of a compound by measuring its melting and boiling points.
- k. Preparation, recrystallisation, determination of melting point and calculation of quantitative yields of
 1. Bromination of Phenol/Aniline.
 2. Benzoylation of amines/phenols.
 3. Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone.

Semester-III

DSC-1C(CC-3): Solutions, Phase equilibrium, Conductance, Electrochemistry & Functional Organic Chemistry

Theory (DSC1CT)

Section A: Physical Chemistry-2

- a) **Solutions:** To know about thermodynamics of ideal solutions, non-ideal solutions, Distillation of solutions, Partial miscibility of liquids, Principle of steam distillation, Nernst distribution law and its applications, solvent extraction.
- b) **Phase Equilibrium:** Student will know about Phases, components and degrees of freedom of a system, Gibbs Phase Rule and its thermodynamic derivation, Clausius – Clapeyron equation, Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, FeCl_3 - H_2O and Na-K only).
- c) **Conductance:** To know Conductivity, equivalent and molar conductivity,

Kohlrausch law, Transference number, Hittorf and Moving boundary methods. Ionic mobility and applications of conductance measurements.

- d) **Electrochemistry:** Students will know about Reversible and irreversible cells, Concept of EMF of a cell, Nernst equation, Types of electrodes, calculation of ΔG , ΔH , ΔS and equilibrium constant from EMF data. Concentration cells with transference and without transference, Liquid junction potential and salt bridge, pH determination using hydrogen electrode and quinhydrone electrode and Potentiometric titrations.

Section B: Organic Chemistry-3

- a) **Carboxylic acids and their derivatives:** Students can learn about preparation and reaction of carboxylic acids and their derivatives.
- b) **Amines and Diazonium Salts:** Students can learn about preparation and reaction of amines and diazonium salts.
- c) **Amino Acids, Peptides and Proteins:** Students can learn about Amino Acids, Peptides and Proteins.
- d) **Carbohydrates:** Students can learn about Carbohydrates.

Practical (DSC1CP)

- a) Students can gather practical knowledge about Distribution, Phase equilibria, Conductometric titration, Potentiometry titration, some Systematic Qualitative Organic Analysis of Organic Compounds and some organic chemistry practical.

SEC-1: Basic Analytical Chemistry

Theory (SEC1T)

- a) Introduction: Students will know introduction to Analytical Chemistry and its interdisciplinary nature.
- b) Analysis of soil, Analysis of water, Analysis of food products, Chromatography Ion-exchange and Analysis of cosmetics.

Practical (SEC1P)

- a) Determination of pH of soil samples. Determination of pH, acidity and alkalinity of a water sample, Determination of dissolved oxygen (DO) of a water sample, Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration, Identification of adulterants in some common food items, Analysis of preservatives and colouring matter, Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}), To compare paint samples by TLC method, Determination of ion exchange capacity of anion / cation exchange resin, Analysis of deodorants and antiperspirants, Determination of constituents of talcum powder.

Semester-IV

DSC-1D(CC-4): Coordination Chemistry, States of matter Chemical Kinetics

Theory (DSC1DT)

- a) **Transition Element:** To know the electronic configuration, stability of various oxidation states and other property of 3d series.
- b) **Co ordination chemistry:** To know the VBT, stereo isomerism in complexes.
- c) **Crystal Field Theory:** To know crystal field effect, octahedral symmetry, CFSE value.
- d) **Kinetic theory of gases and Real gas:** To know the pressure and temperature, mean free path, collision number. To know the viscosity of gas and effect of temperature.
- e) **Liquid:** To know the surface tension and viscosity of liquid and its application.
- f) **Solid:** To know details about solid compounds.
- g) **Chemical kinetics:** To know rate law, order, molecularity, collision theory, Lindemann theory of unimolecular reaction.

Practical (DSC1DP)

- a) Students will perform the semimicro qualitative analysis using H₂S mixtures, measure surface tension, viscosity and the study of kinetics.

SEC-2: Analytical Clinical Biochemistry

Theory (SEC2T)

- a) Basic understanding of the structures, properties and functions of carbohydrates, lipids and proteins: To know about Basic understanding of the structures, properties and functions of carbohydrates, lipids, proteins, hormones, enzymes and structure of DNA and RNA.
- b) Biochemistry of disease: A diagnostic approach by blood/ urine analysis: To know about a diagnostic approach by blood/ urine analysis.

Practical (SEC2P)

- a) Identification or estimation of the following compounds: Carbohydrates, Lipids iodine number of oil, saponification number of oil, cholesterol, Proteins and nucleic acids.

Semester-V

DSE 1: Organometallics, Bioinorganic Chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy

Theory (DSE1T)

Section A: Inorganic Chemistry-4

- a) **Chemistry of 3d metals:** Students will know about preparation and important properties of some 3d metal compounds
- b) **Organometallic Compounds:** Students will know about nature of metal-carbon bond, structures of methyl lithium, Zeiss salt and ferrocene, AN rule, mononuclear and polynuclear carbonyls of 3d metals, p-acceptor behaviour of carbon monoxide and Synergic effects.
- c) **Bio-inorganic Chemistry:** Students will know a brief introduction to bio-inorganic chemistry.

Section B: Organic Chemistry – 4

- a) **Polynuclear and heteronuclear aromatic compounds:** Students will know electrophilic and nucleophilic substitution of Naphthalene, Anthracene, Furan, Pyrrole, Thiophene, and Pyridine.
- b) **Active methylene compounds:** Students will know Claisen ester condensation, Keto-enol tautomerism and synthetic uses of ethylacetoacetate.
- c) **Application of Spectroscopy to Simple Organic Molecules:** Students will know application of spectroscopy to simple organic molecules.

Practical (DSE1P)

- a) Separation of mixtures by chromatography.
- b) Preparation of any two of the following complexes and measurement of their conductivity.
- c) Systematic Qualitative Organic Analysis of Organic Compounds possessing mono functional groups and preparation of one derivatives.

SEC-3: Pharmaceutical Chemistry

Theory (SEC3T)

- a) **Pharmaceutical Chemistry:** To know design, development and basic retro synthetic approach, synthesis representative drugs.
- b) **Fermentation:** To know the fermentation process and production of different compounds.

Practical (SEC3P)

Preparation of Aspirin and magnesium(antacid).

Semester-VI

DSE2: Industrial Chemicals and Environment

Theory (DSE2T)

a. **Industrial Gases and Inorganic Chemicals**

Large scale production, uses, storage and hazards in handling of oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

b. Manufacture, application, analysis and hazards in handling of hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

c. **Industrial Metallurgy**

General Principles of Metallurgy, chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides, hydrometallurgy, methods of purification of metals, Kroll process, parting process, van Arkel-de Boer process and Mond's process.

d. **Environment and its segments**

To know about ecosystems, biogeochemical cycles of carbon, nitrogen and sulphur, air pollution and water pollution.

e. **Energy & Environment**

To know about sources of energy, that is, coal, petrol and natural gas, nuclear fusion / fission, solar energy, hydrogen, geothermal, tidal and hydel.

To know about nuclear pollution, disposal of nuclear waste, nuclear disaster and its management.

f. **Biocatalysis**

To know about biocatalysis, importance of green chemistry and chemical industry.

Practical (DSE2P)

- Determination of dissolved oxygen in water.
- Determination of Chemical Oxygen Demand (COD).
- Determination of Biological Oxygen Demand (BOD).
- Percentage of available chlorine in bleaching powder.
- Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO_3 and potassium chromate).
- Estimation of total alkalinity of water samples using double titration method.
- Measurement of dissolved CO_2 .
- Study of some of the common bio-indicators of pollution.
- Estimation of SPM in air samples.
- Preparation of borax/ boric acid.

SEC-4: Pesticide Chemistry

Theory (SEC4T)

- To know synthesis and technical manufacture and uses of representative

pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor).

Practical (SEC4P)

- a) To calculate acidity/alkalinity in given sample of pesticide formulations as per BIS specifications.
- b) Preparation of simple organophosphates, phosphonates, and thiophosphates.