



Mahatma Gandhi Vidyamandir's

**Loknete Vyankatrao Hiray Arts, Science and Commerce College,
Panchavati, Nashik-422003**

(Affiliated to SPPU, Pune, Reaccredited with 'A' grade, Recipient of Best College Award by SPPU)

Programme Specific Outcomes,

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Course Outcomes of M.Sc

Department of Chemistry

Academic Year

2021-22

Programme Specific Outcomes: M.Sc. Chemistry (PSC)

Name of the Programme: M.Sc Chemistry	
Program Specific Outcomes	
At the end of the programme, student will be able to	
1	have a knowledge of the advanced terms, theories, principles, and techniques of chemistry.
2	get insight about the basics of research.
3	get acquainted with advanced chemistry related equipment.
4	use modern research techniques.
5	have quality assurance and quality control ability required for industry.
6	implement biochemical, pharmaceutical knowledge wherever necessary.

Course Outcomes: M.Sc. Chemistry(PSC)

Semester-I		
Paper	Course code & course title	At the end of the course, student will be able to
I	PSC (CHP-110) (Fundamental of physical chemistry)	Define thermodynamics quantum mechanics, change of state of chemical bonding, chemical kinetics, enzyme catalysis & molecular thermodynamics.
		Explain or discuss concepts of V.B.T Helmholtz function Schrodinger wave function, molecular reaction dynamic explain complex reaction, thermodynamics, collision.
		Apply & calculate problems on quantum chemistry, chemical kinetics, thermodynamics.
		Draw diagram of flash photolysis, flow technique, energy level diagram.
		Estimate Schrodinger equation, normalisation wave function, method for determining of molar qualities V.B.T, chain reaction, Eyring equation, Michalis mechanism attrition function.
		Create a list of quantum mechanics applications in day-to-day life, write H ₂ -Br ₂ mechanism.
II	PSC (CHI-130) Molecular Symmetry and Chemistry of Main Group Elements	Define the concept of point group and trends of periodic table.
		understand the concept of symmetry, symmetry elements, hydrides of alkali and alkaline earth metals
		classify the molecules according to their point group, oxides and oxyacids of phosphorus and sulphur.
		distinguish between the molecules, determine the hybridization and geometry of interhalogen compounds.
		evaluate the point group of different molecules, nature, bonding, geometry of oxides and halides of xenon.
		generate the list of symmetry operations present in a molecule, structure of Boron and carbon containing compounds
III		Draw the reaction and its of mechanism of different rearrangement reaction

	PSC (CHO-150) Basic Organic Chemistry	Understand the basics of redox reaction, criteria of aromaticity, role of various reaction intermediates.
		Understand reaction, its mechanism and uses of different oxidising and reducing agents.
		Explain the stability, reactions, reactivity of reactive intermediate and different ylides.
		decide the concept of heterocyclic chemistry, stereochemistry and its importance.
		Plan the synthetic reagent of oxidation and reduction for solving the problems.
IV	PSC (CHG-190) General Chemistry Section-II	Describe the term related to solid state
		Understand the Chromatographic Techniques
		Explain the gravimetric and volumetric analysis of ores and alloy.
		Prepare the various inorganic complexes and determine its % purity.
		Kinetics of photocatalytic dye degradation by ZnO or TiO ₂
		plan for synthesis of nanoparticles by using sol-gel methods.
V	PSC (CHP-107) Basic Practical Chemistry-I	Find out the Acidity, Basicity and Pka Value on pH meter
		Discuss the preparation of organic compound, their purification and run TLC
		Apply the Stability of complex ion and Standard free energy change and equilibrium constant by Potentiometry
		Explain the energy of activation and second order reaction
		Analyse the Stability of complex ion and standard free energy change and equilibrium constant by Potentiometry.
		Determine specific rotation and % of optically active substances by polarimetrically
Semester-II		
Paper	Course code & course title	At the end of the course, student will be able to

I	PSC(CHP-210) Physical Chemistry-II	define radioactive, nuclear fission, alpha decay, moment of inertia
		Distinguished between rotational vibrational, Harmonic & in harmonic oscillator, nuclear fusion & nuclear fission
		calculate binding energy, mass absorption coefficient, moment of inertia
		draw & label breeder reactor, draw vibrational spectra
		justify Born Oppenheimer approximation, neutron activation analysis, gamma radiography
		propose Frank Condon principle, Geiger -Nuttall law.
II	PSC(CHI-230) Inorganic Chemistry-II	learn quantum number, term, states, spectrochemical series, nephelauxetic series and HSAB, chelate effect.
		Understand interelectronic repulsion, importance and transport of metal ions.
		Solve the problem based on terms, states, microstates, selection rules and recognize the role of metal complexes in biological systems.
		Distinguish between the weak field and strong field splitting of the terms, states and electron transfer reaction, Electrophilic substitution reaction. reactions of coordinated ligands and Template effect, concept of spontaneous self-assembly model compounds.
		Evaluate the selection rules, terms, states and microstates and role of Cu, Fe, Mn and Mo in metalloprotein and metalloenzymes
		Design the correlation table, Orgel diagram, splitting of terms different mechanism involved in exchange of ions across cell wall, Na ⁺ /K ⁺ -ATPase ion pump for active transport of Na ⁺ and K ⁺
III	PSC(CHO-250) Organic Chemistry-II	Describe of photochemistry: Carbonyl compounds, alkenes, dienes polyenes and aromatic compounds.
		Discuss photo rearrangement Barton reaction, application of photochemical reaction.

		Apply Pericyclic reaction: Electro cyclic, Cycloaddition, and Ene Reaction, analysis by correlation diagram, FMO approach and ATS concept.
		Examine the principal factors affecting UV-absorption spectra, Interpret IR spectra on basic values of IR-frequencies.
		Evaluating the problem of UV, IR, PMR, CMR and Mass.
		Prove the Whether the spectral data match with Given organic compound.
IV	PSC(CHG-290) General Chemistry-II	Define the term of co-ordination compounds, Organometallic reaction, Stability constant, Hydrolysis.
		Describe Solubility of a sparingly soluble salts, Dissociation constant, Inert and labile complex, catalytical cycles. Kinetic reactions
		Estimation of Halide by using Potentiometry
		Explain the term related organometallic chemistry
		Evaluate the Graph, Tables and Spectra.
		Prove the whether the compound stable or not stable according to 18 electron rules.
V	PSC (CHP-227) Basic Practical Chemistry-II	Define Solvent free Reaction, Recrystallization, Distillation and stem distillation, Conductometric-ordination compounds, Photochemistry, Chromatography.
		Describe 12 Green principle chemistry, Solvent extraction, Magnetic Susceptibility, Ion exchange chromatography
		Apply Safety techniques for handling of hazardous chemicals.
		Making derivatives of organic compounds will help in Industry, explain Faraday law
		Design to make student aware of green chemistry and role of green chemistry in pollution reductions.
		Plan for synthesis eco-friendly Organic and Inorganic compound by using Green Pathway.

Course Outcomes: M.Sc.-II Organic Chemistry (PSCO)

Semester-III		
Paper	Course code and Course title	At the end of the course, student will be able to
I	PSC(CHO-350) Organic reaction mechanism and Biogenesis	Write a case study report for the separation of natural products from different portions of plants
		Understand the free radical generation methods as well as their stability and reaction mechanism.
		Predict the probable reaction mechanism by following kinetic and non-kinetic methods.
		Examine the reaction series using various parameters of Hammett equation.
		Decide the probable radical reaction mechanism
		Develop an interest in the biogenesis of natural products such as terpenoids, alkaloids, and so on.
II	PSC(CHO-351) Structure Determination of Organic Compounds by Spectroscopic Methods	Describe ¹ H NMR Spectroscopy: Chemical Shift, deshielding, correlation for protons bonded to carbon and other nuclei.
		Discuss of ¹³ C NMR spectroscopy: FT- NMR, type of ¹³ C NMR Spectra, proton decoupled, off resonance, APT, INEPT, DEPT, Chemical shift, nuclear and hetero nuclear coupling constant
		Apply 2D NMR techniques: COSY, homo and hetero nuclear 2D resorts spectroscopy, NOESY and the applications
		Analyse the mass spectrometry: Instrumentation, various methods of ionization, SIMS, FAB, MALDI. Different detectors rules of fragmentations of different functional groups.
		Prove the proton Homotopic, Enantiotopic and Diastereotopic by using NMR spectroscopy.
		Plan to use NMR for prediction of organic Structure.
III	PSC(CHO-352) Stereochemistry and asymmetric	Remember the stereochemistry of a six-member ring.
		Understand fused bridge and Caged rings, Transannular effect, I strain.
		Explain resolution of racemic modification, stereochemistry of organic compounds using NMR.

	Synthesis of Organic Compounds	Examine stereochemistry of rings other than six members.
		Identify geometrical isomerism and stereochemistry of olefins.
		Design Cram's rule, Felkin-Anh rule, Cram's chelate model asymmetric synthesis using chiral reagent.
IV	PSC(CHO-353) Protection Deprotection, Chiron Approach and Carbohydrates Chemistry	Describe the molecular pathways that allow carbohydrates to be modified
		Discuss the chiral approach, the concept of chiral templates, and how to use the basic principle in a retrosynthetic strategy.
		Explain classification system for carbohydrates.
		Apply the concept of protection Deprotection in organic Synthesis.
		Create a variety of carbohydrate structures.
		Design of organic synthesis, hydroxyl, amino carboxyl, ketones, and aldehyde protection deprotection
V	PSC(CHO-354) Solvent free reaction	Describe atom economy
		Understand the supramolecular reaction
		Apply the Green chemistry Principle in Organic synthesis.
		Analyse reaction progression by using TLC
		Develop and Design the Environmentally Friendly Pathway.
		Rewrite mechanism of C-C, C-X, C-N, C-S bond formation Reaction.
Semester-IV		
I	PSC(CHO-450) Chemistry of natural product	Study structure and stereochemistry Longifolene
		Explain the total synthesis Hirsute lone B, Ribisins A and B, Subincanadine E
		Understanding the synthesis of Vannusals and Pinnaic acid.
		Analyses the reported research data of natural products.
		Evaluate stereochemistry of natural products using case study.
		Rewrite the total Synthesis of Hirsutellone B, Ribisins A& B .
II	PSC(CHO-451) Organometallic Reagents in Organic Synthesis	Define Click Reaction, Wittig Reaction, Multi component, Metathesis. Organometallic compounds.
		Discuss the term ring formation reactions C=C bond formation reactions
		Explain the C=C formation process, as well as multi-compound and ring formation reactions.
		Use of Boron and silicon reagent in organic synthesis.

		Decide the reaction mechanism of Multicomponent reaction, boron and silicon in cycloaddition synthesis of organic compounds
		Investigation into Sharpless azides the usage of boron and silicon in cycloaddition synthesis of organic compounds
III	PSC(CHO-452) A) Medicinal chemistry	Define chiral drug, antimicrobial drugs, antibacterial, antifungal, antiviral, antimalarial etc.
		Understanding of the basic biological and pharmacological interactions by using both natural products and total synthesis of bioactive molecules.
		Use of corresponding knowledge for the development of biologically and clinically active drugs.
		Explain the structure, activity and drug targets.
		Decide the mechanism of drug absorption, distribution.
		Plan for advanced courses in natural products, organic synthesis, medicinal chemistry; fundamentals of cell biology, molecular biology, drug design, and analytical methods.
IV	PSC(CHO-453) Ternary Mixture separation, carbohydrate synthesis and Isolation Natural Products and Project	Understand and employ the concept of type determination and separation.
		Meticulously record physical constants.
		Perform micro scale chemical elemental analysis, qualitative estimation of functional groups.
		Extend these skills to organic synthesis.
		Plan for the development of the products like Soap, Perfumes from essential oils.
		Select methods, conclude the methods of project. Make table, flowsheet, diagram
V	PSC(CHO-454) Convergent and Divergent	Describe the term Convergent and Divergent.
		understand to synthesis Quinoline by convergent method.
		Explain the term multicomponent reaction
		Analyse reaction progression by using TLC.reaction completed or not
		Predict the mechanism of multicomponent reaction.
Plan to synthesize organic reactions by using Divergent.		

Course Outcomes: M.Sc.-II Physical Chemistry(PSCP)

Semester-III		
Paper	Course code and Course title	At the end of the course, student will be able to
I	PSC(CHP-310) Quantum and solid-state chemistry	Defines Eigen value & Eigen function, angular momentum operator, point defect, ferrimagnetism, intrinsic & extrinsic semiconductor.
		Explain variation method, properties of quantum mechanical Operators, Dielectric properties, PN Junction.
		Calculate wave function of Helium atom, spin orbit coupling, total Hamiltonian Operator.
		Distinguished between schottky defect & Frenkel defect, edge dislocation & Screw dislocation , elastic & plastic deformation, perturbation & variation method.
		Principle pauli's exclusion principle, & Slater determinant, Approximation, Piezoelectricity, Photoconductivity of crystal.
		Discuss properties of quantum mechanical Operators, Theory of crystal growth, band Theory, optical properties.
II	PSC(CHP-311) Nuclear radiation and polymer chemistry	define ultracentrifugation, nuclear reactor, viscosity, copolymerization, entropy, isobars.
		distinguished between nuclear fusion & fission, thermoplastic & thermosetting, liquid drop model & shell model
		Calculate binding energy, average molecular weight of polymer, entropy and heat of mixing
		Explain the term ion beam analysis, end group analysis
		Estimate the ultracentrifugation method, viscosity, osmometry, diffusion, light scattering
		Prove flory kringbum theory , solid state semiconductor detector theory
III	PSC(CHP-312) Physicochemical methods of analysis	Understand the concept of X - ray luminescence. Inductively coupled plasma atomic emission spectroscopy
		Introduce concepts of voltammetry coulometry and thermal methods to provide fundamental knowledge .

		Apply Volta metric application ICPAES technique for determination of traces of metal from wine Measurement of SEM excitation signal
		Distinguish between Fluorescence and phosphorescence, TGA and DTA, chemiluminescence and electrochemiluminescence
		Construct the hydrodynamic voltammetry.
		Propose the theory of ESCA.
IV	PSC(CHP-313) Photochemistry and Techniques in polymer chemistry	Define photochemistry, fluorescence, phosphorescence, viscous flow, solar energy, moulding , vulcanization , reinforcement, carbon black, polymer
		Explain the theory of Photoluminescence, photocatalysis process, Jablonski diagram, copolymerization, stern - volmer equation, solar energy, Actinometry, block copolymerisation ,energy transfer mechanism
		Solve quantum yield, number of Einstein, wavelength of radiation
		Distinguished between fluorescence and phosphorescence, Branch polymer and linear polymer, Thermoplastic and Thermosetting, addition polymer and. Condensation polymer
		Prove Stern Volmer equation
		Create a list of polymers used in day-to-day life.
VI	PSC(CHP-314) Physical chemistry practical I	Define triiodide ion formation, dipole moment, Actinometry, viscosity, chain linkage, Lamberts and beer's law
		Describe dipole moment, chain linkage
		Use of colorimeter, pH metre, spectrophotometer
		Explain triiodide ion formations, viscosity, photolysis
		Find out the acidity, basicity and pka value on the pH meter.
		Set up the apparatus properly for the given experiment; perform all the activities in the laboratory with neatness and cleanness.
Semester-IV		
		Define nuclear spin, chemical shift, spin spin interaction, X-Ray diffraction, magnetic susceptibility, coupling constants, splitting
		Distinguished between diamagnetic susceptibility & paramagnetic susceptibility, magnetic susceptibility by Faraday &

I	PSC(CHP-410) Molecular structure and spectroscopy	gouy Technique, isotropic & anisotropic hyperfine coupling constant, ferro and Antiferromagnetic.
		Compare X-ray diffraction & electron diffraction, ESR&NMR
		Calculate the chemical shift, coupling constants, spacing between crystals, wavelength with the help of Braggs equation, number of unpaired electrons, neutron electron diffraction analysis.
		Value of degeneracy, factor affecting on g value, factors influencing coupling constants g value
		Construction of nuclear resonance spectroscopy, electron resonance spectroscopy Magnetic susceptibility.
II	PSC(CHP-411) Surface chemistry and electrochemistry	Define adsorption, porous solids, flux, absorption ,adsorbate, adsorbent, standard electrode potential
		Explain wetting, floatation, detergency, Li-ion battery
		Apply Debye-Huckel limiting law , Einstein relationship between absolute mobility and diffusion coefficient
		Distinguished between adsorption and absorption, primary and secondary power cell.
		Calculate diffusion coefficient, equivalent conductivity, absolute and convection mobility
		Create a list of primary cells, secondary cells and fuel cells.
III	PSC(CHP-412) Biophysical chemistry and special topic in nuclear and radiation chemistry	Define Protein, ATP, ADP, DNA ,RNA ,X-ray diffraction ,chain congratulations ribozymes , radiation hazard
		Explain Michaelis–Menten kinetics, Braggs law, molecular structure, radioactive waste management, biological effects of radiation
		Use of radiation for food preservation and sterilization, use. of nuclear properties of indicator nuclides
		Distinguished DNA and RNA. , Nucleic acid and amino acid
		Justify. Biological effects of radiation
		Plan radioactive waste management
IV	PSC(CHP-413) Physical	Define Hydrolysis constant, clock reaction, order of reaction, diffusion coefficient, and critical temperature.
		Describe GM counter,

	chemistry practical III	Analysis of fruit juice for vitamin C by HPLC Technique.
		Arrange the apparatus properly for the given experiment, perform all the activities in the laboratory with neatness and cleanness.
		Select methods, conclude the methods of project.
		Make table, flow sheet, diagram
V	PSC(CHP-414) Physical chemistry practical II	Define solubility, polybasic acid, transport no, chain linkage, TGA, beer's law
		described formula complex of silver ammonium salt
		Use of colorimeter, pH metre , spectrophotometer, conductometer
		Explain ternary system, solubility, pH metry
		Find out solubility, phenol water system and pka value on pH meter
		Set up the apparatus properly for the given experiment, perform all the activities in the laboratory with neatness and cleanness.

Course Outcomes: M.Sc.-II Inorganic Chemistry (PSCI)

Semester-III		
Paper	Course code and Course title	At the end of the course, student will be able to
I	PSC(CHI-330) Organometallic and Homogeneous catalysis	Define Metal carbonyl, carbene, carbocyclic polyenes, Phosphine complex, Homogeneous and Heterogeneous catalyst.
		Explain the method of carbon multiple bonded compounds.
		Predict the product of oxidative addition
		Distinguish between electrophile and Nucleophile
		Justify Tollens catalytic cycle
		Make a Structure of carbene, carbyne carbocyclic polymers.
II	PSC(CHI-331) Inorganic Reaction Mechanism	Define the terms Trans effect, labile Complexes, electron transfer reaction, photochemical reaction. Quantum yield, labile Complexes, Inert complexes. Photochemical reaction, prompt and delayed reactions, quantum yield.
		Discuss the Substitution reaction in octahedral complexes, photochemical reactions involving chlorophyll.
		Explain Substitution in square planar complexes, Substitution in octahedral complexes SN1, SN2, SN1CB, Electron Transfer reactions, Inner & Outer sphere reactions.
		classify Chelate ring forming reaction, Non Chelate ring forming reaction
		Distinguish between d-d Transition and CT transitions, fluorescence and phosphorescence, prompt and delayed reactions
		Justify Photochemical reactions, types of Inorganic Reactions
III	PSC(CHI-332) Bioinorganic and Medicinal inorganic chemistry	Define Bioinorganic chemistry, MRI, Radiopharmaceutical, enzyme Biochemistry, Chrysotherapy.
		Explain the terms Interaction of Metal Complexes with DNA, Cis platin as Anticancer Agents, Therapeutic radiopharmaceuticals, Gold Complexes with Antitumor, Describe Antagonism between

		Cu & Mo. Explain Reactions of Metal Complexes with DNA, Biomedical Uses of Lithium
		Classify zinc and Copper enzymes, Non-heme Iron, Molybdenum enzymes.
		Distinguish between heme iron and non-heme iron, copper I, copper II and copper III protein.
		Select Transition Metal Complexes as Chemical Nucleases, select radiopharmaceuticals drugs for bone imaging.
		Design vit B12, haemoglobin, zinc fingers, manganese enzyme.
IV	PSC(CHI-333) Modern Instrumental methods in inorganic chemistry	Define Fluorescence, Photodegradation, Magnetic susceptibility
		Explain Principle, instrumentation, working and applications of following TGA, DTA, DSC, TPD
		Use of X-Ray diffraction NMR
		calculate the spectra ESR, NMR
		Distinguished between DTA and DSC, Cyclic voltammetry and Hydrodynamic voltammetry
		Justify TGA method for chemical analysis
VI	PSC(CHI-334) Modern methods of inorganic Analysis	Define alloy, ore, pigments, cement, ion exchange chromatography, Minerals, standard solution, normal solution, photochemistry
		Explain principle of ion exchange chromatography, gravimetric analysis, volumetric analysis, laws of kinetics, standardisation of solution
		Classify the chromatography, conductometry, photometry
		Distinguish between cation exchange resin and anion exchange resin, alloy and ore, ore and minerals
		Select the indicator for standardisation of solution, rate the following reaction.
		Make the flow sheet of ore analysis, flow sheet of alloy analysis, design the structure of ferrocene, tetrakis(triphenylphosphine)nickel II complex.
Semester-IV		
		Define heterogeneous catalyst, adsorption isotherm.

I	PSC(CHI-430) Heterogeneous catalyst and its application	Explain the principle of heterogeneous catalysis
		Use of the Heterogeneous catalyst in Organic synthesis.
		Described the factors influencing catalytic action promoters and poison.
		Justify Zeolite framework.
		Make a structure Zeolite Framework.
II	PSC(CHI-431) Inorganic nanomaterials	Define nanotechnology Nano etymology, Nanotoxicology, Wet nanotechnology, Dry nanotechnology, Computational nanotechnology
		Explain Stalwarts of nanotechnology-Feynman, Drexler and Taniguchi, Moore's law, hysico-chemical characteristic dependent toxicology, Epidemiological evidences
		Distinguished between the Wet nanotechnology And Dry nanotechnology
		Mechanical properties and electronic properties Analysis of a) Carbon nanomaterial b) Nano composites include metal nanomaterial such as single particle as well as core shell nanomaterial.
		Compose the structure of nanomaterial.
		plans for preparation of size dependence Nano material
III	PSC(CHI-432) Material science	Define Crystal defects, Non stoichiometry, Diffusion in solids,Magnetic Materials,
		Superconductivity, Ceramic Materials, Composite Materials, Cementitious Materials
		Explain Preparation methods of solids, BCS theory, properties and polarization properties
		Properties of ceramics, concrete and asphalt materials,
		Application of cementitious materials, biomaterials and biocompatibility
		Make a structure of Crystal defects.
IV	PSC(CHI-433) Project	Define environmental problem Identify methods,label the diagram
		Explain conclusion, application methods, compare methods

		Predict structure calculate value
		Investigate problems; construct the scheme,flow sheet.
		Select methods, conclude the methods of project.
		Make table,flow sheet,diagram
V	PSC(CHI-434) Inorganic Instrumental analysis and computer application, Preparation of inorganic compounds	Define TGA,magnetic moment, aquation reaction,Isomerisation reaction, coordinate bond, nanomaterial
		Explain the terms cyclic voltammetry, principle of TGA, IR, NMR, XRD.
		Classify the solid-state materials, standard substances, ligands, types of inorganic reactions, nanomaterial's, Ferrites.
		Distinguish between primary standard and secondary standard substances, normal and molar solution.
		Select the method for synthesis of ZnO, Zinc ferrites, Nickel ferrites
		Design the structure of [Mn(salen)], tris(triphenylphosphine) nickel(II) complexes.