

Program Name: **M. Sc. Chemistry**

Program specific Outcomes

A student completing this program will be able to

PSO1: Knowledge: Apply the basic knowledge of inorganic, organic, physical and analytical chemistry, in the various fields of pharmaceutical sciences, environmental sciences, forensic sciences and biochemical analysis

PSO2: Laboratory skills: Apply various techniques for the qualitative and quantitative analyses based on instrumental and physico-chemical methods as well as apply the principles of synthetic organic chemistry for organic preparation.

PSO3: Environmental concern: Become aware about various kinds of environmental pollution and apply the principles of green chemistry in industrial and laboratory processes

PSO4: Employability/future prospects: Develop analytical and problem- solving skills as well as apply good laboratory practices necessary for performing various activities in the industry

PSO5: Scientific communication: To develop scientific communication skills, thereby the students are able to express ideas clearly and convincingly, in written and oral forms.

Course outcomes for all courses offered by the department:

Semester	Course code	Course name	Course Outcomes Student completing this course is able to
1	PCH-1801	Inorganic Chemistry I	1: Apply the approximation methods in quantum theory to solve the Schrodinger wave equation for multielectronic atomic systems such as helium 2: Use molecular symmetry and group theory to simplify problems involving molecular properties 3: Remember the basic laws and mechanisms of magnetochemistry and recognize different magnetic materials 4: Remember the structure and functioning of natural bio-inorganic molecules as well as appraise the role of synthetic coordination compounds in therapy
1	PCH-1802	Organic Chemistry I	1: Apply the knowledge of basic organic reaction mechanisms to infer various aspects of elimination reaction, nucleophilic reactions and molecular rearrangements 2: Remember the generation and reactivity of reactive intermediates like carbocations, carbanions etc 3: apply the theories of aromaticity to examine molecules and predict their aromatic and antiaromatic character

			4: employ the fundamentals of stereochemistry to predict the configuration of complex chiral molecules and their roles in enantioselective synthesis
1	PCH-1803	Physical Chemistry I	<p>1: Employ the fundamentals of thermodynamics to examine the third law as well as interpret the changes from ideal to real states for solutions and gases</p> <p>2: use the principles of chemical kinetics to derive the rate equations for complex and fast reactions as well as remember the experimental techniques used to study the kinetics of these reactions</p> <p>3: employ the fundamentals of solid-state chemistry to examine the bonding in solids and interpret phenomenon such as diffusion and electrical conduction and super conduction in solids</p> <p>4: Use the BET adsorption isotherms to calculate surface area, surface tension etc; to understand heat of adsorption and ways of determining it and using this to understand more about micelles</p>
1	PCH-1804	Analytical Chemistry I	<p>1: identify the sampling technique and calibration method for a given sample/glassware etc. and to learn about validation of analytical methods using different statistical parameters</p> <p>2: Identify, recognize and remember the fundamentals of UV-Vis spectrophotometry and apply them effectively for structural and quantitative analysis of molecules and complexes</p> <p>3: Remember the principle of thermal analysis and recognize the different techniques/instrumentation like DSC, DTA etc for industrial applications</p>
1	PCH-1805L	Inorganic and Organic Chemistry Practicals I	<p>1: Use the fundamentals of semi-micro qualitative analysis to determine six radicals in an unknown mixture</p> <p>2: Perform green preparation of complexes</p> <p>3: Use the fundamentals of organic synthesis to prepare a variety of organic molecules</p> <p>4: Perform organic estimation of some functional groups</p>
1	PCH-1806L	Physical and Analytical Chemistry Practicals I	<p>1: Use the conductometer to do acid-base titrations involving mixtures</p> <p>2: Use the potentiometer to determine solubility product and oxidation potentials</p> <p>3: Use the pH meter to do acid-base titrations to determine the assay of a drug and concentration in mixtures</p> <p>4: Perform experiments based on adsorption and kinetics</p>

			<p>5: Perform experiments based on distribution coefficient</p> <p>6: Calibrate glass wares used in an analytical laboratory</p> <p>7: Perform titrations to determine the assay of drugs and other commercial preparations</p> <p>8: Perform water analysis</p>
2	PCH-2801	Inorganic Chemistry II	<p>1: Apply the principles of VSEPR and molecular orbital theory to deduce the properties of conjugated systems, conductors, semi-conductors and insulators</p> <p>2: Use the basics of molecular symmetry and spectroscopy to predict the IR and Raman spectra of molecules</p> <p>3: To recognize the bonding modes in organometallic compounds with various organic ligands</p> <p>4: To remember the reaction mechanisms in coordination compounds</p>
2	PCH-2802	Organic Chemistry II	<p>1: To recognize the selectivity and utility of a variety of reagents in organic reactions</p> <p>2: To remember the mechanism and synthetic applications of name reactions</p> <p>3: To apply the fundamental knowledge of heterocycles to elucidate the synthesis, structure and application of polyheteroatomic and benzofused heterocycles</p>
2	PCH-2803	Physical Chemistry II	<p>1: To identify the principles of statistical thermodynamics and hence apply statistical mechanics to molecular problems of chemical thermodynamics</p> <p>2: To identify the various aspects of nuclear chemistry to define its application in energy generation and therapeutics</p> <p>3: use the basic principles of physical chemistry to determine the kinetics, thermodynamics and molecular mass of polymers</p> <p>4: Apply the fundamentals of overvoltage, decomposition potentials and electrochemical polarization to explain the theory and working of polarography</p>
2	PCH-2804	Analytical Chemistry II	<p>1: To use different techniques like liquid-liquid extraction, counter current extraction, digestion and solid phase extraction for sample preparation</p> <p>2: To identify as well as remember the principles and theory of chromatography and to apply them to interpret and use data generated by specialized chromatographic techniques such as GC, HPLC, HPTLC and IEC</p>

			3: To apply the principles of electrochemistry in the quantitative analysis of various ionic solutions using different types of ion selective electrodes
2	PCH-2805L	Inorganic and Organic Chemistry Practicals II	1: To prepare and determine the purity of double and complex salts 2: To perform the colorimetric estimation of some transition metals using complexation 3: To apply the principles of organic spotting to analyse ternary organic mixtures
2	PCH-2806L	Physical and Analytical Chemistry Practicals II	1: Use the conductometer to verify Ostwald's dilution law and Debye-Huckel-Onsager's equation 2: Use the potentiometer to perform acid-base titrations, precipitation titration and redox titrations 3: Use the pH meter to do determine the dissociation constant of a weak acid and the ionization constant of a tribasic acid 4: Perform experiments based on kinetics 5: Perform experiments based on distribution coefficient 6: Perform environmental analysis like determination of DO, COD 7: Perform titrations to determine the assay of drugs and other commercial preparations 8: Perform water and oil analysis
3	PCH-3801	Natural Products and Biomolecules	1: Remember the classification, synthesis, biosynthesis and biochemical roles of some natural pigments, alkaloids, vitamins, steroids, hormones, terpenoids and carotenoids 2: Employ the fundamentals of organic reaction mechanisms for the structure elucidation of some natural pigments, alkaloids, vitamins, steroids, hormones, terpenoids and carotenoids
3	PCH-3802	Medicinal Chemistry	1: Identify the classes, synthetic routes and mechanism of action of drugs that act as antibiotics, psychoactive agents, antimalarials, antitubercular agents, cardiovascular, diuretics and hypoglycemic agents 2: Remember the structure activity relationship (SAR) of some drugs that act as antibiotics, psychoactive agents, antimalarial and antituberculosis agents, cardiovascular, diuretics and hypoglycemic agents and co-relate their chemical structure to the biological activity
3	PCH-3803	Organic Spectroscopy	1: Remember the principle, instrumentation of ¹³ C-NMR and ¹ H-NMR as well as their advanced applications in DEPT, 2D-NMR. NOE, COSY and HETCOR

			<p>2: Identify the various methods for the ionization of molecules, recognize the different modes of fragmentation, the rules for molecular mass determination as well as the instrumentation of a mass spectrometer</p> <p>3: Employ the knowledge of spectroscopy and spectral interpretations to determine the structure of molecules</p>
3	PCH-3804	Industrial Chemistry	<p>1: Describe unit processes such as nitration, sulphonation etc as well as unit operations such as crystallization, filtration etc</p> <p>2: remember the 12 principles of green chemistry, recognize green reagents, solvents, catalysts and use them efficiently for designing green processes</p> <p>3: Give an outline regarding the raw materials used in the cosmetic industry especially in baby care, hair care, dental care and synthetic perfumes</p> <p>4: Describe the classification of textile and non-textile dyes; their synthesis and the basic operations in the process of dyeing</p>
3	PCH-3805L	Organic Preparations	<p>1: Prepare compounds of industrial importance by using name reactions such as Sandmeyer reaction, Pechmann reaction, Skraup synthesis, Riemer-Tiemann reaction, Kolbe-smith reaction, Claisen-smith synthesis, Hoffman reaction, Diels-alder reaction, Green –bromination</p> <p>2: Use the fundamentals of organic reaction mechanism to determine the mechanisms of these name reactions</p> <p>3: Characterize the compound prepared</p>
3	PCH-3806L	Organic Estimations	<p>1: Use the fundamental analytical techniques to determine the assay of drugs</p> <p>2: Perform non-aqueous titrations</p> <p>3: Determine the nitrite value of the given solution</p> <p>4: Extract casein from milk</p>
4	PCH-4801	Advanced Organic Chemistry	<p>1: Illustrate the applications of the Woodward-Hofmann, FMO and PMO method in determination of the stereochemical outcome of pericyclic reactions such as electrocyclic, cycloaddition and sigmatropic reactions</p> <p>2: Use the fundamentals of conformational analysis to determine the stable conformations of simple, substituted and heterocyclic saturated ring systems</p> <p>3: Describe the mechanism of aliphatic electrophilic substitution reactions and the properties of the electrophiles involved</p>

			4: Illustrate the modern types of organic synthetic methodologies and also describe some modern name reactions
4	PCH-4802	Advanced Organic Synthesis	1: Describe the principles involved in protection of functional groups during organic synthesis 2: Remember the fundamentals of the disconnection approach and identify the principles of retrosynthesis to carry out C-C disconnections 3: Use basic organic chemistry to remember the synthesis of saturated and aromatic heterocyclic rings
4	PCH-4803	Bioorganic Chemistry	1: Remember the fundamentals of biochemistry in the context of amino acids, peptides and nucleic acids 2: Summarise the basic biochemical reactions and processes involved in metabolism of carbohydrates, proteins and fatty acids 3: Explain the structure, functions and complex reactions/processes undergone by nucleic acids, carbohydrates and vitamins
4	PCH-4804	Selected topics in Medicinal Chemistry	1: Recognize the principles involved in drug design and describe the different aspects of medicinal chemistry such as pharmacokinetics, pharmacodynamics, drug activity theories, clinical trials etc 2: Describe the quality control and assurance methods used in the pharma industries as well as the different routes of administration and dosage forms 3: Identify the use of computers in chemistry and locate the databases available for literature survey in medicinal chemistry 4: Compile the nanomaterials and nanotechnology-based devices used for tackling problems in pharmacokinetics and pharmacodynamics
4	PCH-4805L	Industrial training	1: Apply the theories and concepts learned in real-life world 2: Communicate and present the applications, training and experience from the industrial training 3: Analyse the observations from the industrial training
4	PCH-4806L	Organic Preparations and Estimations	1: Prepare compounds of industrial importance by using starting materials having specific functional groups

			<p>2: Use the fundamentals of organic reaction mechanism to determine the mechanisms of these name reactions</p> <p>3: Characterize the compound prepared</p> <p>4: Use the fundamental analytical techniques to determine the assay of drugs</p>
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