Department of Chemistry Pondicherry University

Mapping of Program Outcomes and Course Outcomes

Five-Year Integrated M.Sc. Chemistry

and

Two-Year M.Sc. Chemistry Programs

Program Outcomes (POs):

PO1: Students can design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

PO2: Students can develop skills in problem solving, critical thinking and analytical reasoning as applied to scientific problems.

PO3: Students can develop ability to communicate the results of scientific work in oral, written, and electronic formats to both scientists and the public at large.

PO4: Students will acquire skills to explore new areas of research in chemistry and allied fields of science and technology.

PO5: Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behavior in issues facing chemists, including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health, medicine, and chemical industries.

PO6: Students can explain why chemistry is an integral activity for addressing social, economic, and environmental problems.

PO7: Students will function as members of an interdisciplinary problem-solving team.

Course code	Title	Course Outcomes (COs)	CO-PO Mapping							
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	
CHEM 110	General Chemistry Laboratory I	Students will acquire hands-on experience in chemical experiments	\checkmark	\checkmark	\checkmark	\checkmark				
CHEM 120	General Chemistry Laboratory II	Students will acquire hands-on experience in chemical experiments	\checkmark	\checkmark	\checkmark	\checkmark				
CHEM 210	Chemistry Laboratory III	Students will acquire hands-on experience in chemical experiments	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark			

CHEM 220	Chemistry Laboratory IV	Students will acquire hands-on experience in chemical experiments	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
CHEM 310	Chemistry Laboratory V	Students will acquire hands-on experience in chemical experiments	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
CHEM 320	Chemistry Laboratory VI	Students will acquire hands-on experience in chemical experiments	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
CHEM 111	Principles of General Chemistry I	Students will acquire knowledge on electronic structure of atoms, quantum numbers, atomic orbitals and concept of chemical bonding.		~	\checkmark	~	~	\checkmark	
CHEM 121	Principles of General Chemistry II	Students will acquire knowledge on concept on equilibrium and its application to study chemical phenomenon. They will learn the concept of radioactivity, metallurgy and their applications. They will gain knowledge of organic functional groups and biomolecules.		~	~	~	~	~	
CHEM 211	Basic Inorganic Chemistry I	Students will understand periodic trends and chemistry of various elements. They can relate chemical properties of various elements with respect to their position in the periodic table.		~	~		~	~	
CHEM 212	Mathematics for Chemists	This course prepares students to understand essential mathematical principles required to understand quantum chemistry, chemical bonding, group theory, spectroscopy and perform	\checkmark	~	~				

			1		1		1		
		computational							
		chemistry							
		calculations.							
		The diversity and							
		complexity of binary	./	./	./				
	. .	compound of carbon	v	v	V				
	Organic	with hydrogen.							
	Chemistry I:	The effect of							
CHEM	Structure and	structural features on							
221	Functionalizin	physical and		\checkmark	\checkmark	\checkmark			
	g	chemical properties							
	Hydrocarbons	The structure and							
		The structure and				./	./	./	
		functionalization of			V	v	V	v	
		hydrocarbons							
		Apply the postulates							
		of quantum mechanics							
		to simple systems of							
		chemical interest, such							
		as the particle-in-a-		\checkmark	\checkmark				
		box, harmonic							
		oscillator, rigid rotor,							
		hydrogenic atoms,							
		hybrid orbitals.							
	T / T / · /	Visualize atomic							
CHEM	Introduction to	orbitals of hydrogenic	\checkmark	\checkmark	\checkmark				
CHEM	Quantum	atoms.							
	Chemistry and	Shall have ability to							
	molecular	solve introductory	1	1	1				
	Symmetry	problems in quantum	•	•	•				
		mechanics.							
		Shall have ability to							
		identify various							
		molecular symmetry							
		elements and				1	1		
		their operations and	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
		construct group							
		multiplication table							
		and character table							
		Studente will be able			+	-	-		
		to goin knowledge							
	Dagia	to gain knowledge							
CHEM	Dasic	about coordination		./					
311	Inorganic	compounds,		V	v	v	v	v	
	Chemistry II	lanthanides and							
		actinides and their							
		applications.							

CHEM 312	Organic Chemistry II Functional Group Transformatio n	Students will be able to identify the nucleophile, electrophile, and free radical and their reactivity pattern. Identify the oxidation states of carbon- bearing functional groups. Students will be able to transform	~	✓ ✓	✓ ✓	✓ ✓	 ✓ 		
CHEM	Equilibrium	functional groups. Evaluate various thermochemical properties from different experimental variables.	✓	✓	✓	 ✓ 	 ✓ 		
313	Thermodynam ics Reaction Kinetics	From solving problems, students may realise the connection between thermodynamics with biological systems and natural processes.		\checkmark	\checkmark	~	\checkmark		\checkmark
CHEM 321	Basic Inorganic Chemistry III	Students will be able to predict and analyse properties of main group elements and their various structural features.		\checkmark	\checkmark	~	\checkmark	\checkmark	
		Effect of replacing carbon/s by heteroatom/s on properties of aromatic hydrocarbons.	\checkmark	~	\checkmark	\checkmark	\checkmark		
CHEM 322	Organic Chemistry III Bioorganic Chemistry	Application of functional group transformations in synthesis of heteroaromatics.		\checkmark	\checkmark	~	\checkmark	\checkmark	
		Recognizing the structure and chemistry of biomolecules	\checkmark	\checkmark	\checkmark	\checkmark	~		

CHEM 323	Eco-friendly Chemistry – Principles and Practices	Learners will be able to recognize and appreciate the need for environmentally benign chemistry practices and the principles and methods of practicing eco-friendly chemistry.	~	~	~	~	~	~	
		Understand properties of gases from first principle and can appreciate the concept of pressure and its relation to speed distribution.	\checkmark	~	~		~		
CHEM 324	Kinetic Theory of Gases and Chemical Kinetics	Explain ionic mobility and its		\checkmark	\checkmark	\checkmark	\checkmark		
		Derive and discuss rates of simple and complex reaction kinetics.		\checkmark	\checkmark	\checkmark			
		Derive and discuss about surface kinetics and photo excited states kinetics.		\checkmark	\checkmark	\checkmark	\checkmark		
		Solve problems using kinetic theory of gases and reaction kinetics.		\checkmark	\checkmark	\checkmark	\checkmark		\checkmark
CHEM 410	Advanced Chemistry Laboratory I	Students will be able to carry out chemical reactions, characterization and analysis.	\checkmark	\checkmark	~	\checkmark	\checkmark	\checkmark	\checkmark
		Identify and assign shapes and molecular symmetry elements.	\checkmark	\checkmark	\checkmark	\checkmark			
CHEM 411	Symmetry and	Construct character tables and identify their significance.	\checkmark	\checkmark	\checkmark		\checkmark		
411	Structure	Visualize, identify, evaluate, 3D molecular structures and energetics of isomers		\checkmark	\checkmark		\checkmark		

		Understand the structural features of solids.	\checkmark	\checkmark		\checkmark	\checkmark	\checkmark
		Determine the electronic structure of an atom		\checkmark	\checkmark	\checkmark		
CHEM 412	Electronic Structure	Understand the theoretical basis for the arrangement of electrons.		✓	\checkmark	\checkmark		~
		Determine the nature of diatomic systems.		\checkmark	\checkmark		\checkmark	
		Recognize the nature of bonds, and orbitals.		\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
CHEM 413	Chemical Bonding	Predict the nature of bond and its properties through various Electronic structural methods.		~	\checkmark	\checkmark	\checkmark	
		Understanding the bonding models and intermolecular interactions.	\checkmark	\checkmark	\checkmark		\checkmark	\checkmark
CHEM	Chemical	Student will learn fundamental chemical thermodynamics and be able to use this in experimental and theoretical work with chemical systems.	\checkmark	\checkmark	~			
414	Reactions and Energetics	Understand the molecular basis for the bulk thermodynamic properties.	\checkmark	\checkmark	~	~		

		Students will acquire knowledge to understand and interpret various physical and biological processes in terms of their thermodynamicstabili ty.	v	/	√	✓	~	✓	
CHEM 415	Chemistry of Main Group Elements	Students will be able to predict and analyse properties of main group elements and their various structural features.	v	/	\checkmark	\checkmark	\checkmark	✓	
		Skills to be developed			\checkmark	\checkmark	\checkmark		\checkmark
CHEM	Advanced	Evaluation procedure			\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
420	Chemistry Laboratory II	Students may understand and write mechanisms for various chemical reactions	v	/	\checkmark	\checkmark	\checkmark	\checkmark	
CHEM 421	Reaction Kinetics and mechanism	Knowledge about speed of the reaction and its dependence on various variables gives an insight to understand mechanisms of reactions.	v	/	\checkmark	~	~		
		Students may understand and write mechanisms for various chemical reactions	v	/	\checkmark	\checkmark	\checkmark	\checkmark	
CHEM 422	Structure and Spectra: Electronic, Vibrational, Microwave	Course describes the basic theory of magnetic resonance applied to chemical systems.	•	/	\checkmark	\checkmark	\checkmark		

		Later in the course, the instrumentation study this property and how to this property is employed to solve chemical structures.	~	~	~	~	~		\checkmark
		Students may be asked to record at least one sample (or teacher may share the experimental data).		~	~	~	~		✓
		After completing this course should be able to solve chemical structures by identifying various aspects of the spectrum.		~	~	~	~	\checkmark	\checkmark
		Explain the reasons of NMR peaks, their positions, splitting patterns, and peak widths.	\checkmark	~	~	~	~		
CHEM	Structure and	Explain the paramagnetic properties of a material.	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark
423	Magnetic Resonance	Explain the fragmentation patterns in Mass spectra	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
		Determine the chemical structure of the organic compounds from different spectroscopic data.	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark
CHEM 424	Structure and Bonding in Coordination Organometalli c Compounds of Transition Metals	Students will be able to gain complete knowledge about coordination compounds and their applications. They can understand and infer various properties of coordination and		\checkmark	\checkmark	~	\checkmark	\checkmark	~

		organometallic compounds.							
CHEM 510	Graduate Research Laboratory	Students will acquire knowledge on experimental skill, collection of relevant literature, work ethics, chemistry concepts related to the research project and article writing skills.	~	~	~	~	~	~	✓
CHEM 511	Summer Internship	Students will gain experience in research lab/industry. They get exposure to diversified work culture and domain knowledge. Students will acquire the skills of identifying a new research project, analyse the results and documentation.	~	~	~	~	~	~	~
CHEM 520	Research Project	Students will acquire knowledge on experimental skill, collection of relevant literature, work ethics, chemistry concepts related to the research project and article writing skills. Students will be able to get hands on experience of doing research.	~	~	~	~	~	~	✓
CHEM 521	Seminar Participation and Review Writing	Students will acquire knowledge about the contemporary research areas in chemistry/allied sciences through seminar participation. They collect literature, compile	~	~	~	~	\checkmark	\checkmark	

		data and write a							
		review report.							
		Students will acquire							
	Structure and	knowledge to relate							
CHEM	Reaction	reactions of inorganic			,				,
551	of Transition	systems with		\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
	Metal	reference to their							
	Compounds	structures and their							
		electronic properties.							
		Students will be able							
		to understand the							
	Selected	magnetic and spectral							
CHEM	Topics in	properties with their	./	./		./	./	./	./
552	Inorganic	structures and will	v	V		v	v	v	v
	Chemistry	have knowledge in							
		synthesising materials							
		properties							
		Students will be able							
		to design and							
CHEM	Supramolecul	synthesize new							
553	ar Chemistry	molecules with	\checkmark	\checkmark		\checkmark	\checkmark	\checkmark	\checkmark
		different shapes and							
		their applications.							
		Students will							
СПЕМ	Ligand Field	understand and							,
554	Theory	interpret the electronic	\checkmark	\checkmark	\checkmark	\checkmark			\checkmark
554	Theory	properties of metal							
		Students will							
		understand the							
CHEN		structural features of							
CHEM	Bioinorganic	biological systems	\checkmark			\checkmark	\checkmark	\checkmark	\checkmark
222	Chemistry	involving metal ions							
		and their activities							
		and mechanisms.							
		aware of various							
OUE	Inorganic	photophysical and							
CHEM	Photochemistr	photochemical	\checkmark	$ $ \checkmark		\checkmark	\checkmark		\checkmark
330	У	processes involved in							
		coordination							
		complexes.							

CHEM 557	Catalysis Concepts and Applications	Students will be equipped with designing metal complexes with catalytic reactivity for various organic transformations.	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	~
CHEM	Advanced Organic	Learners will be able to analyse an organic reaction by applying the principles of thermodynamics and kinetics.	✓	~		✓	~	\checkmark	
220	Chemistry	To describe and predict the possible mechanism of an organic reaction.		\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
CHEM 559	Asymmetric Synthesis	Learners will be able to explain the need for synthesising biologically active compounds in optically pure form, the principles and strategies of making enantio-enriched compounds.	~	~	~	~	~	~	
CHEM 561	Chemistry of Aromatics	Learners will be able to describe the structural feature, types of aromatic compounds and unique properties of aromatic compounds, predict the properties of aromatic compounds.	\checkmark		~	~	~	~	
		Learners will be able to develop various methods of synthesis and funtionalization of aromatic compounds.		\checkmark	~	\checkmark		\checkmark	
CHEM 562	Organic Synthesis and Approaches	On successful completion of this course learners will be able to analyse a given target molecule, identify simple reactants and reactions to make	\checkmark	\checkmark	~	\checkmark	~	\checkmark	

		various bonds and write a synthetic protocol to synthesise the given target molecule.							
CHEM 563	Organic synthesis – Methodology (Reagents in Organic Synthesis)	Learners will be able to analyse a given target molecule, identify simple reactants and reagents to make various bonds to synthesize a given target molecule.	~	~	~	~	~	~	~
CHEM 564	Selected named organic reactions	This course will be able to identify suitable name reaction for a given organic transformation and recognise the relation in given set of named organic reactions.	~	~	~	~	~	~	\searrow
CHEM	Natural Products	Learners will be able to recognize and appreciate various classes of natural products, their sources, and application.	~	~	~	~	\checkmark		
565	Chemistry	Describe the structural feature andbiosynthesis of representative examples of each class of natural product.		\checkmark	\checkmark	\checkmark	✓	✓	
CHEM 566	Organic synthesis for chemical	Learners will be able to recognize and appreciate the relevance of organic chemistry to biology,	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
	principles and practices	Aware of the trend in contemporary organic synthesis to make organic synthesis more relevant to	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		

		study biological phenomenon.							
		r							
CHEM 567	Polymer Science: Synthesis, Characterizatio n	Learners will able to describe how structural complexity can be built from simple molecules, general structural feature of monomers, methods of polymer synthesis, characterization and properties of polymers.	✓	~	~	~	~	✓	
		Learners will be able to recognize and appreciate the principles drug discovery process.	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
CHEM 568	Drug design and discovery	Comprehend the structure and functions of targets, interaction between small molecules and targets and their effects, metabolism and excretion of a drug and approaches to rational drug design design.	\checkmark	~		~	~	~	
CHEM 569	Chirotechnolog y	Learners will be able to apply the principles of asymmetric synthesis to develop industrial processes for making important chiral molecules in optically pure form.	\checkmark	~	~	~	\checkmark	~	✓
CHEM 571	Statistical Thermodyna mics	Account for the physical interpretation of partition functions		\checkmark	\checkmark	\checkmark	\checkmark		

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			Able to calculate thermodynamic properties of model systems with using Boltzmann -, Fermi- Dirac and Bose- Einstein statistics.	\checkmark	~	~	
			Account for the physical interpretation of distribution functions.	\checkmark	\checkmark	\checkmark	
			Discuss and show how these can be used in calculations of basic thermodynamic properties.	~	\checkmark	\checkmark	
			Calculate physical characteristics of non-ideal gases and liquids using the most common models for fluids.	\checkmark	\checkmark	\checkmark	
	CHEM	Electroanalyti	Offers a unique access to information on chemical, biochemical, and physical systems through applying potential and/or current to the systems.	~	~	~	
572	cal Techniques	Both the instrumental basis and the theoretical fundamentals are discussed such that non-specialists can easily apply them.	~	\checkmark	\checkmark	✓	

		Addresses chemists and biochemists who are interested in using electroanalytical techniques to supplement spectroscopic and perhaps theoretical calculations.		~	~	~	~
		Addresses biologists, environmental and material scientists, physicists, medical scientists, and, most importantly, students in all branches of science, who are confronted with the need to apply electroanalytical techniques.	~	~	~	~	~
CHEM 573	Molecular Reaction Dynamics	Seeks to describe why a particular experiment was carried out, what we have learned, what concepts are necessary to describe and understand the experiment, and how we move forward.		~	~	~	
CHEM 574	Nanomaterial	Developing a basic understanding of properties of nano materials	~	\checkmark	\checkmark	\checkmark	
	and Photo- catalysis	Application of such materials in varieties of fields like electronics, solar energy harvesting etc.	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
CHEM 575	Solid State Chemistry	Physical Methods for characterizing solids		\checkmark	\checkmark	\checkmark	\checkmark

		Thermal, Electrical and Magnetic properties of Solids			\checkmark	\checkmark	\checkmark		
		Surface Chemistry: Heterogeneous catalysis			\checkmark	\checkmark	\checkmark		\checkmark
CHEM 576	Analytical Techniques in Chemistry	Students will be able to develop analytical methods and perform chemometric analysis to understand the diverse aspects of analytical applications.	\checkmark	~	\checkmark	\checkmark		~	~
CHEM 577	Chromatogra phic Separation Methods	Students will acquire knowledge on various chromatographic separation techniques andanalyse the results.	\checkmark		\checkmark	\checkmark		\checkmark	\checkmark
		Guide to help navigate among different computational methods currently in use.		\checkmark	\checkmark	\checkmark	~		
CHEM 578	Computationa l Quantum Chemistry:	Provides a compact description of the basis of computational chemistry along with many examples of applications of these methods in various areas.		~	~	~	~		
	Molecules	Applications include descriptions of standard chemical calculations for model molecules under various conditions.		~	~	~	\checkmark		
		Provides information on prediction of various molecular properties as well as investigations of chemical reactions.		\checkmark	\checkmark	\checkmark	\checkmark		

CHEM 579	Computationa l Quantum Chemistry: Materials	Provides information on prediction of various molecular properties of periodic materials like crystals, amorphous solids, surface properties, catalytic reactions.		~	~	~	~		\checkmark
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