Payyanur College, Payyanur
(Affiliated to Kannur University)

Programme Outcomes (POs)

MSc PROGRAMME (FOR SCIENCE)

PROGRAMME OUTCOMES (PO)

PO1. Advanced Knowledge & Skills:

Postgraduate courses aim to provide students with in-depth knowledge and advanced skills related to their chosen field. The best outcome would be to acquire a comprehensive understanding of the subject matter and develop specialized expertise.

PO2. Research & Analytical Abilities:

Research and Analytical Abilities: Postgraduate programs often emphasize research and analytical thinking. The ability to conduct independent research, analyse complex problems, and propose innovative solutions is highly valued.

PO3. Critical Thinking & Problem-Solving Skills:

Developing critical thinking skills is crucial for postgraduate students. Being able to evaluate information critically, identify patterns, and solve problems creatively are important outcomes of these programs.

PO4. Effective Communication Skills:

Strong communication skills, both written and verbal, are essential in various professional settings. Postgraduate programs should focus on enhancing communication abilities to effectively convey ideas, present research findings and engage in academic discussions.

PO5. Ethical & Professional Standards:

Graduates should uphold ethical and professional standards relevant to their field. Understanding and adhering to professional ethics and practices are important outcomes of postgraduate education.

PO6. Career Readiness:

Postgraduate programs should equip students with the necessary skills and knowledge to succeed in their chosen careers. This includes practical skills, industry-specific knowledge, and an understanding of the job market and its requirements.

PO7. Networking & Collaboration:

Building a professional network and collaborating with peers and experts in the field are valuable outcomes. These connections can lead to opportunities for research collaborations, internships and employment prospects.

PO8. Lifelong Learning:

Postgraduate education should instill a passion for lifelong learning. The ability to adapt to new developments in the field, pursue further education, and stay updated with emerging trends is a desirable outcome.

Programme Specific Outcomes (PSOs)

Name of the Programme: **MSc CHEMISTRY**

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1.

ln-depth knowledge of core concepts: Understanding of the fundamental principles and theories in various sub-disciplines of chemistry, including organic, inorganic, physical, analytical and theoretical chemistry.

PSO2.

Advanced laboratory skills: Possess advanced laboratory skills necessary for planning, executing and analysing experiments in diverse areas of chemistry. This includes skill in handling chemical reagents, instruments and equipment, as well as accurate measurement techniques.

PSO3.

Research and scientific inquiry: Exhibit competence in designing and conducting independent research projects in chemistry, including formulating research questions, implementing methodologies, collecting and interpreting data, and drawing appropriate conclusions.

PSO4.

Critical thinking, data analysis, interpretation, and problem-solving: Apply critical thinking skills to analyse complex chemical problems and propose innovative solutions. Effective in interpreting experimental data using appropriate statistical methods and computational tools.

PSO5.

Effective communication: Communicate scientific ideas, research findings, and complex concepts effectively through written reports, research papers, and oral presentations.

PSO6.

Safety and ethical practices: Awareness of ethical principles and safety protocols in all aspects of chemical research and laboratory work.

PSO7.

Interdisciplinary knowledge and collaboration: Display the ability to integrate knowledge from various field, collaborate with interdisciplinary teams, and apply chermical principles to solve problems in related areas, such as environmental science, materials science, pharmaceuticals, biochemistry, nanoscience etc.

Course Outcomes (COs)

Name of the Programme: **MSc CHEMISTRY**

COURSE OUTCOMES (COs)

Sl. No	Name of the Course	Outcomes
1.	**MSCHE0lC0l: THEORETICAL CHEMISTRY - I**	**CO1.** Understand and examine the basic principles of Quantum Mechanics. **CO2.** Apply the postulates of quantum mechanics to simple systems. **CO3.** Make use of the approximation methods to calculate the properties of simple systems. **CO4.** Demonstrate the principles of chemical bonding in diatomic and polyatomic molecules. **CO5.** Apply HMO theory to simple conjugated systems.
2.	**MSCHE01C02: INORGANIC CHEMISTRY - I**	**COl:** Apply the theory of precipitation phenomena in the determination of metal ions. **CO2:** Impart advanced knowledge of the theory of complexometric titration. **CO3:** Predict the stabilities of complexes based on the HSAB principle. **CO4:** Understand different types of Non-aqueous solvents and their applications. **CO5:** Develop and attain advanced knowledge of nuclear Chemistry and radiation Chemistry and their applications. **CO6:** Demonstrate the preparation, structure, and properties of compounds of Boron, Phosphorous and Nitrogen.
3.	**MSCHE01C03: ORGANIC CHEMISTRY - I**	**COl.** Study the various reaction intermediates in organic reactions. **CO2.** Investigate the role of reaction conditions and reagents in the generation of intermediates. **CO3.** Formulate a mechanism for the suggested reactions. **CO4.** Analyse the structure-property relations in aliphatic substitution reactions. Apply the concept of elimination to various organic molecules. **CO5.** Understand the various aromatic systems and their reactions. Classify molecules based on the aromatic behaviour.

		CO6. Study the different photochemical reactions and apply to natural photochemical reactions.
4.	**MSCHE01C04: PHYSICAL CHEMISTRY - I**	**CO1.** Illustrate the concepts of the third law of thermodynamics and thermodynamic irreversibility. **CO2.** Analyse phase transitions and phase diagrams of three component systems. **CO3.** Develop an understanding of the theoretical aspects of electrochemical activities and various facets of electrochemistry. **CO4.** Interpret the mechanism of electrode-electrolyte interaction. **CO5.** Analyse different aspects of the electrode process. **CO6.** Illustrate the importance and concepts of electrochemistry in other fields like supercapacitors, batteries, and corrosion.
5.	**MSCHEO2C08: THEORETICAL CHEMISTRY - II**	**CO1.** Analyse the symmetry aspects of a given molecule and find its point group. **CO2.** Explain the basic principles of group theory and construction of the character table. **CO3.** Apply the principles of group theory to spectroscopy and chemical bonding. **CO4.** Understand the interaction of matter with radiation in terms of the relation with the molecular energy levels. **CO5.** Explain and apply the selection rules pertaining to various molecular spectral transitions. **CO6.** Develop advanced awareness about the various spectroscopic techniques- IR, Raman, Electronic, and NMR.
6.	**MSCHE02C09: INORGANIC CHEMISTRY - II**	**COl:** Develop advanced knowledge about the VB and MO theory of coordination compounds. **CO2:** Explain the spectroscopic features of complexes and interpret the spectra of complexes. **CO3:** Describe the magnetic behaviour of complexes and apply magnetic properties in the structural determination of complexes. **CO4:** Understand the various mechanisms operative in inorganic complexes during substitution and in electron transfer reactions.

		CO5: Explain different physical methods in Inorganic chemical analysis
7.	**MSCHE02C10: ORGANIC CHEMISTRY - II**	**COl.** Understand the basic concepts of conformational analysis and evaluate the effect of conformational changes in molecular reactions. **CO2.** Apply the basic concepts of stereochemistry in stereoselective asymmetric synthesis. **CO3.** Understand molecular orbital approaches in pericyclic reactions. **CO4.** Formulate mechanisms for pericyclic reactions and problems. **CO5.** Understand and analyse various name reactions in organic chemistry. **CO6.** Generate mechanisms for reactions and understand the basic concepts for asymmetric synthetic reagents.
8.	**MSCHE02C11: PHYSICAL CHEMISTRY - ll**	**COl.** Apply the theory and methods of the statistical approach of thermodynamics. **CO2.** Analyse different classical and quantum mechanical distribution functions. **CO3.** Interpret classical and quantum statistical mechanics, including Boltzmann, Fermi-Dirac, and Bose-Einstein statistics. **CO4.** Illustrate band theory and the reciprocal lattice (k-space) formalism in terms of the crystal lattice. **CO5.** Analyse the theory of X-ray diffraction in solids. **CO6.** Develop an idea of different solid properties, focusing on electric and magnetic properties.
9.	**MSCHE0I&02C05: INORGANIC CHEMISTRY PRACTICAL- I**	**CO1:** Identify advanced laboratory practices and develop laboratory skills through hands on experiences. **CO2:** Identify the cations including rare elements, in a mixture of unknown salts. **CO3:** Analyse metal ions using the volumetric method. **CO4:** Analyse water quality parameters like hardness and DO. **CO5:** Synthesize and characterize metal complexes of historical importance by various physicochemical methods.

		CO6: Record, interpret and analyse UV-Vis and IR spectra, TG curves, and XRD patterns of different metal complexes. **CO7:** Predict the spectral characteristics of a given metal complex.
10.	**MSCHE01&02C06: ORGANIC CHEMISTRY PRACTICAL - I**	**COl.** Develop hands-on laboratory experience in the separation and purification of organic compounds. **CO2.** Analyse organic compounds and acquire lab skills in the synthesis of organic compounds. **CO3.** Determine physical constants and purification techniques. **CO4.** Develop skills in chromatography.
11.	**MSCHE01&02C07: PHYSICAL CHEMISTRY PRACTICAL - I**	**COl.** Correlate and experimentally verify basic electrochemical principles related to conductance. mobility, and activities of ions. **CO2.** Estimate concentration and molecular weights using cryoscopic methods. **CO3.** Analyse physical constants like viscosity to determine the composition and molecular weights in the solution. **CO4.** Perform electrochemical titrations in the laboratory by measuring the conductance and potential of solutions, and determination of dissociation constants of acids. **CO5.** Apply Physical chemistry concepts in the areas as of phase equilibrium.
12.	**MSCHE03&04C15: INORGANIC CHEMISTRY PRACTICAL - II**	**COl.** Predict the methods for separation cations of a mixture. **CO2.** Estimate metal ions present in a binary mixture following volumetric, gravimetric, and colorimetric methods. **CO3.** Interpret data from an experiment, including constructing appropriate graphs and evaluating errors. **CO4.** Analyse alloys and detect the cations present. **CO5.** Analyse trace metals using optical methods. **CO6.** Synthesize and characterize nanoparticles by various methods.
13.	**MSCHE03&04C16: ORGANIC CHEMISTRY**	**CO1.** Develop lab skills in the extraction of natural compounds and qualitative analysis. **CO2.** Synthesize and purify organic compounds.

	PRACTICAL - II	**CO3.** Develop skills in chromatographic techniques. **CO4.** Analyse, examine, and solve spectral data.
14.	**MSCHE03&04CI7: PHYSICAL CHEMISTRY PRACTICAL - II**	**COl.** Experimentally analyse the concepts related to the kinetic aspects of chemical reactions determination of concentration from graphs based on surface chemistry concepts. **CO2.** Utilize stereochemical principles related to optical isomers to determine the concentration and kinetic parameters of specific reactions. **CO3**. Apply UV-Visible spectroscopy to determine solution concentration, complex formation, equilibrium constant, metal ion concentration. **CO4.** Perform basic spectral calculations and determination of specific parameters from UV-Visible spectroscopy and X-ray diffraction data. **CO5.** Apply Computational chemistry to perform single-point energy calculation, geometry optimization, and Frontier orbital calculation at the HF level of theory
15.	**MSCHE03C13 ORGANIC CHEMISTRY – III**	**CO1.** Understand the basics UV-Visible spectroscopy **CO2.** Study the applications of electronic and IR spectroscopy in simple organic molecules. **CO3.** Predict the structure of organic molecules using NMR spectroscopy **CO4.** Differentiate the principle of HNMR and 13C NMR spectroscopy **CO5.** Understand the basic principle of Mass spectroscopy and formulate methods to identify organic molecules using this technique **CO6.** Illucidate and analyse the structure of different heterocyclic compounds and biomolecules
16.	**MSCHE03C14 PHYSICAL CHEMISTRY – III**	**CO1.** To get an understanding of kinetic aspect of chemical reactions. **CO2.** To infer kinetic approach of Catalysis. **CO3.** To get a knowledge on surface chemistry and different surface catalysed reactions. **CO4.** To identify the colloidal system emphasizing on its stability and properties.
ELECTIVE COURSES		
17.	**MSCHE04E01 INTER DISCIPLINARY**	**CO1.** To get knowledge about Supramolecular Chemistry

	TOPICS AND INSTRUMENTATION TECHNIQUES	**CO2.**To know the Principle of Green Chemistry and methods of Green Synthesis **CO3.** To get an understanding about Nano Science and Technology **CO4.** To be able to explain Electron Spin Resonance Spectra **CO5.** To be able to explain Mossbauer Spectra
18.	**MSCHE04E02 COMPUTATIONAL CHEMISTRY**	**CO1.** Understand the theoretical foundations of computational chemistry. Analyze the importance of quantum mechanics in understanding molecular behavior. **CO2.** Classify and evaluate computational methods in chemistry. Categorize computational methods based on their approaches and applications. **CO3.** Apply ab Initio and semi-empirical methods in computational chemistry. Assess the strengths and limitations of these methods. **CO4.** Demonstrate proficiency in the use of basis sets and molecular orbitals in computational chemistry. (i) Discuss the role of basis sets in electronic structure calculations. (ii) Critically evaluate the advantages and limitations of different basis sets. **CO5.** Utilize Density Functional Theory (DFT) to study molecular systems. (i) Understand the foundations of DFT and its significance. (ii) Apply various DFT functionals for electronic structure calculations. **CO6.** Employ molecular dynamics simulations to study molecular structures and interactions. (i) Explain the principles of molecular dynamics. (ii) Implement force fields for molecular simulations. (iii)Analyze molecular dynamics trajectories to understand structural changes and interactions. **CO7.** Conduct computational spectroscopy to predict vibrational, electronic, and NMR spectra. Prepare input programs in Gaussian / GAMESS format for various calculations.
19.	**MSCHE04E03 BIOCHEMISTRY**	**CO1.** To impart advanced knowledge about biomolecules as building blocks of life **CO2.** To discuss the metabolisms of carbohydrates, lipids, proteins and nucleic acids in organisms

		CO3. To discuss the significances of endocrine glands and their hormones in human body **CO4.** To apply the knowledge of endocrine hormonal action in understanding endocrine disorders **CO5.** To understand the importance of enzymes in metabolic reactions
20.	**MSCHE04E04 NANOMATERIAL CHEMISTRY**	**CO1.** Understand the history and mile stones in nanotechnology. **CO2.** To Provide an insights to various physical and chemical synthesis methods of nanomaterials **CO3.** To apply the basic knowledge of spectroscopy techniques in nano material characterization **CO4.** Analyse the applications of nanomaterials in energy, environment, electronic and magnetic fields.
21.	**MSCHE04E05 POLYMER CHEMISTRY**	**CO1.** To get an understanding about properties of polymers and mechanism of different types of polymerization. **CO2.** To get a knowledge on different characterization in polymers. **CO3.** To identify different polymerization process and polymer reactions **CO4.** To differentiate applications of different polymers
22.	**MSCHE04E06 MATERIAL CHEMISTRY**	**CO1.** To have a basic and general understanding about materials and material science related to engineering **CO2.** To study about various types of materials important in the context of industrial applications **CO3.** To understand the chemistry particularly electrical, magnetic and structural aspects of ceramics, composite and materials for special purposes **CO4.** To study about the mechanism of processing, formation, stability and bonding in various types of materials