

**SCHOOL OF VOCATIONAL STUDIES & APPLIED  
SCIENCES**

**Programme and Course Objectives**

***DEPARTMENT OF APPLIED CHEMISTRY***

## **Department of Applied Chemistry**

**NUMBER OF PROGRAMMES OFFERED : 04**

**Ph.D in Applied Chemistry**

**M. Sc. Applied Chemistry**

**B.Sc [Hons.] Chemistry**

**PG Diploma in Polyurethane Technology**

**[Industry-Academia collaborative Program]**

<b>Program Name</b>		<b>Ph.D in Chemistry</b>	
<b>Objectives</b>		To harness the ' <i>spirit of inquiry</i> ' through a well developed process map for creating leadership mindset in research and academics.	
<b>S.N</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Objectives</b>
1	AS601	Research Methodology Credit-4	Students should be able to understand basic concept of research and its methodologies.
2	RPE601	Research and Publication Ethics Credit-2	To maintain a clean and honest research paradigm to retain the dignity and integrity of the body of work within the scientific community.
3	CH601	Physical methods in chemistry –I Credit-3	To use the basics of UV-Visible ,IR NMR and mass spectroscopy, AAS for analysis, characterization and structure elucidation of sample
4	CH602	Physical methods in chemistry –II Credit-3	To characterize the prepared material by using microscopic, spectroscopic, diffraction, adsorption and thermal techniques,X-ray Transmission electron microscopy (TEM), scanning electron microscopy(SEM).
5.	CH603	Seminar Credit:2	To enable students to enhance their presentation skill, communication skills, debating skill ,interacting skills and refinement of their own language for analyzing and reflecting their research work.
Total Credit		14	

**Name of the Program: M. Sc. Applied Chemistry**

**Program Objective** - M.Sc in Applied Chemistry is the flagship course of the department. It aims to embellish science graduates' "knowledge box" by offering flexible choice based syllabi for a career in interdisciplinary research, academics, R&D labs as well as industrial and chemical organisations.

S. No.	Code	Course Name	Category	L-T-P	Credit	Course Objective
<b>Semester- I total Credit=24</b>						
1.	CH 401	Physical Chemistry-I	C	4-0-0	4	To recapitulate all the laws of thermodynamics and energy dynamic of system and surroundings and to deliver in-depth knowledge of chemical kinetics, theories, electrochemistry and its application.
2.	CH 403	Inorganic Chemistry-I	C	4-0-0	4	Students should have a clear concept of Different theories of bonding in coordinate chemistry, reaction mechanism of metal complexes group theory and its application.
3.	CH 405	Organic Chemistry-I	C	4-0-0	4	Students should gain a strong concept of reactive intermediates and reaction mechanism
4.	CH 407	Characterization Techniques-I	C	4-0-0	4	To gain knowledge about the principle of various existing techniques for the characterization of materials which help to determine composition and structure of material.
5.	CH 409	Laboratory-I	C	0-0-8	4	To provide practical training on identification of various functional group present in organic compounds and develop the skills and strategic approaches for organic synthesis.
6.	CH 411	Laboratory-II	C	0-0-8	4	To provide practical knowledge of chemical kinetics, conductometry, titrimetry and separation techniques

**Semester- II Total Credit=27**

1.	CH 402	Physical Chemistry-II	C	4-0-0	4	To Understand and Familiarize with the main aspects of the historical development and concept of quantum mechanics, surface chemistry, phase equilibrium photochemistry and its application
2.	CH 404	Inorganic Chemistry-II	C	4-0-0	4	Student should learn various aspects of spectra and magnetism in coordinate compounds gain knowledge about metal clusters and metal Pi –complexes.
3.	CH 406	Organic Chemistry-II	C	4-0-0	4	To understand stereo chemistry in detail and to familiarize with the pericyclic reactions in reference of different types of organic reactions
4.	CH 408	Green Chemistry -I	C	2-0-0	2	To understand Basic and advance principles of green chemistry that eliminates the generation of hazardous substances in the design, manufacture and application of chemical products.
5.	CH 410	Laboratory-III	C	0-0-8	4	The students should be able to synthesise complex inorganic compounds and organic compounds and explore separation techniques of two metals ions and separation of organic mixtures.
6.	CH 412	Laboratory-IV	C	0-0-8	4	To have detailed understanding of construction of phase diagram, various phenomenon in surface chemistry, spectral techniques used in determining concentration and $\lambda$ max. of compounds
7.	CH 414	Computational Chemistry	AECC	0-0-4	2	It is a ability enhancement compulsory course (AECC), students should be able to know about computational chemistry, its applications methods and field of application such as drug design
8.	<b>DSE-I (Select any one)</b>					
i.	CH 416	Medicinal Chemistry -I	DSE	3-0-0	3	To make students aware of various approaches of drug development, SAR studies, PK/PD studies and Combinatorial chemistry etc.

ii.	CH 418	Biomolecules-I	DSE	3-0-0	3	To learn about biological properties, structure and their derivatives of Carbohydrates, Lipids, Amino-acids, Peptides and Protein and basic idea for DNA-interactive drugs, Toxicity of DNA-interactive drugs etc.
iii.	CH 420	Polymer-I	DSE	3-0-0	3	To provide a fundamental knowledge of polymers, their classification, bonding in polymers, mechanism of polymerization and why polymers are different from small molecules?
iv	CH422	Bioinorganic Chemistry-I	DSE	3-0-0	3	To enable students to rationalize the essential roles of the "inorganic" elements (Ca, Mg, K, Na, Co, Zn, Mo, Cr, Cu, Fe) in biology and the geobiosphere.
<b>Semester III                      Total Credit=28</b>						
1.	CH 501	Summer Training ( 4-6weeks duration)	C	0-0-0	2	To familiarize students with the working of organizations across various sectors in specific functional domains.
2.	CH 503	Green Chemistry-II	C	3-0-0	3	To make students aware of how chemical processes can be designed, developed and run in a <i>sustainable</i> way based on <i>10 principles of Green Chemistry</i>
3.	CH 505	Intellectual Property Rights (IPR)	C	3-0-0	3	To introduce fundamental aspects of Intellectual property Rights , patents, trademark, copyright and registration aspects
4.	CH 507	Laboratory-V	C	0-0-8	4	To do hands on exercise on synthesis of drugs, isolation of natural products and testing of antimicrobial activity.
5.	CH 509	Laboratory-VI	C	0-0-8	4	To know the synthesis and characterization of nanoparticles and how to do the analysis and characterization of polymer.
6.		*Generic Elective (Select any one)	GE*	3-0-0	3	From other department

7.	<b>DSE-II (Select any one)</b>					
i.	CH 511	Medicinal Chemistry-II	DSE	3-0-0	3	To Study the chemical synthesis of selected drugs ,general mode of action and medicinal uses of important drugs in the field of CNS,Cardiovascular System, Antipyretics Analgesics and Anti-inflammatory etc
ii.	CH 513	Bioinorganic Chemistry-II	DSE	3-0-0	3	To study the role of metal ions in carcinogenesis and concepts on metal ion toxicity and their role in Chelation therapy, radiodiagnostic agent, MRI and X-ray contrast agent.
iii.	CH 515	Polymer-II	DSE	3-0-0	3	To learn about Polymer Properties, polymer solution, Polymerization Practice, Polymer Processing etc.
8.	<b>DSE-III (Select any one)</b>					
i.	CH 517	Catalysis	DSE	3-0-0	3	To learn about Fundamentals: ofCatalysis, Types of catalysis and characterization of solid catalysts, determination of particle size byX-ray diffraction - SEM, TEM, XPS and TPD, TPR for acidity and basicity of the catalysts.
ii.	CH 519	Characterization Techniques-II	DSE	3-0-0	3	To learn about various characterization technique like titrimetric analysis, thermal methods of analysis, X-ray & neutron diffraction, neutron diffraction, theory, Instrumentation and application
iii.	CH 521	Nanomaterials	DSE	3-0-0	3	To learn about Fundamentals of nanomaterials ,their synthesis, characterization and application.
9.	<b>DSE-IV (Select any one)</b>					
i	CH 523	Biomolecules-II	DSE	3-0-0	3	To explore chemistry of natural product (alkaloids, terpenoids and carotenoids) their biosynthesis, structure determination and applications.

ii	CH 525	Some Industrial Chemicals	DSE	3-0-0	3	To gain knowledge of chemicals used in different industries like dyes industry, Oils and Oleochemicals industry, cosmetics and perfumes industry etc. (synthesis, properties and applications)
<b>Semester- IV -Credits:20</b>						
1.	CH502	Project			20	To give students exposure to design and conduct research under supervision of faculty members involved in concurrent research projects/ external lab ongoing projects
<b>Total Credits:99</b>						



<b>Program Name</b>	<b>B.Sc [Hons.]Chemistry - Choice Based Credit System (CBCS)</b>					
<b>Objectives</b>	To offer a flexible programme comprising core, elective and skill based courses while ensuring that the student gets a strong foundation in the subject of their choice and gains in-depth knowledge to secure their paths towards further higher studies or suitable employment					
<b>SEMESTER I</b>						
<b>S.No</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credit</b>	<b>Course Objectives</b>
1	<b>CHH101</b>	Inorganic Chemistry-I <i>Atomic Structure &amp; Chemical Bonding</i>	Core Course	4-0-0	4	To review the structure of the atom and Chemical Bonding in compounds.
2	<b>CHH103</b>	Inorganic Chemistry Lab-I	Core Course Practical	0-0-4	2	To interpret the observations and results in the practical with the concepts learned in theory
3	<b>CHH105</b>	Physical Chemistry-I <i>States of Matter &amp; Ionic Equilibrium</i>	Core Course	4-0-0	4	To understand states of matter and interchange of states, intermolecular interactions.
4	<b>CHH107</b>	Physical Chemistry Lab-I	Core CoursePractical	0-0-4	2	To develop understanding of practical aspect of physical chemistry experiment.
<b>SEMESTER II</b>						

1	<b>CHH102</b>	Organic Chemistry-I <i>Basics &amp; Hydrocarbons</i>	Core Course	4-0-0	4	To understand and explain the differential behavior of organic compounds based on fundamental concepts learnt.
2	<b>CHH104</b>	Organic Chemistry Lab-I	Core Course Practical	0-0-4	2	To learn purification, separation and determination of organic compounds.
3	<b>CHH106</b>	Physical Chemistry-II <i>Chemical Thermodynamics &amp; its Applications</i>	Core Course	4-0-0	4	To make students understand the concepts of energy, heat, work, enthalpy, entropy, free energies and the relation between them.
4	<b>CHH108</b>	Physical Chemistry Lab-I	Core Course Practical	0-0-4	2	To learn various aspects of Thermo Chemistry.
<b>SEMESTER III</b>						
1	<b>CHH201</b>	Inorganic Chemistry-II <i>s- and p-Block Elements</i>	Core Course	4-0-0	4	To review the general principals of Metallurgy and s-, p-block elements.
2	<b>CHH203</b>	Inorganic Chemistry Lab-II	Core Course Practical	0-0-4	2	To learn about Iodo / Iodimetric Titrations and preparation of Inorganic compounds
3	<b>CHH205</b>	Organic Chemistry-II <i>Oxygen Containing Functional Groups</i>	Core Course	4-0-0	4	To give a better understanding of the organic functional groups, which include halogenated hydrocarbons and oxygen containing functional groups and their reactivity patterns.
4	<b>CHH207</b>	Organic Chemistry Lab-II	Core Course Practical	0-0-4	2	To impart knowledge of detection of Functional group and Organic preparations.

5	<b>CHH209</b>	Physical Chemistry-III <i>Phase Equilibria &amp; Chemical Kinetics</i>	Core Course	4-0-0	4	To understand concepts of electrochemistry, batteries and phase diagram.
6	<b>CHH211</b>	Physical Chemistry Lab-III Core Course-VII Practical	Core Course Practical	0-0-4	2	To learn Phase equilibria and construction of the phase diagram.
7	<b>CHH213</b>	Intellectual Property Rights	Skill Enhancement Course -1	4-0-0	4	To give insights into the basics of the Intellectual Property (IP) and in its wider purview it encompasses intricacies relating to IP.
<b>SEMESTER IV</b>						
1	<b>CHH202</b>	Inorganic Chemistry III <i>Coordination Chemistry</i>	Core Course	4-0-0	4	To enhance the knowledge on coordination compounds, metallurgy and their applications.
2	<b>CHH204</b>	Inorganic Chemistry Lab III -Course VIII Practical	Core Course Practical	0-0-4	2	To correlate the theoretical concepts with practical applications in preparation of coordination compounds and their properties.
3	<b>CHH206</b>	Organic Chemistry III <i>Heterocyclic Chemistry</i>	Core Course	4-0-0	4	To familiarize students to the details of Nitrogen containing functional groups, heterocyclic systems and natural compounds.
4	<b>CHH208</b>	Organic Chemistry Lab- III	Core Course Practical	0-0-4	2	To learn detection of elements and organic compounds containing simple Functional group (nitro, amine and amide groups).
5	<b>CHH210</b>	Physical Chemistry IV <i>Conductance &amp; Chemical Kinetics</i>	Core Course	4-0-0	4	To make the students understand the concept of chemical reaction of kinetics catalysis and photochemical reactions.

6	<b>CHH212</b>	Physical Chemistry Lab- IV	Core Course Practical	0-0-4	2	To determine cell constant, degree of dissociation and dissociation constant of a weak acid by Conductometry.
7	<b>CHH214</b>	Pharmaceutical Chemistry	Skill Enhancement Course-2	4-0-0	4	To develop basic understanding of drugs discovery, design and development.
<b>SEMESTER V</b>						
1	<b>CHH301</b>	Organic Chemistry IV <i>Biomolecules</i>	Core Course	4-0-0	4	To study about the concepts of properties and biological role of biomolecules.
2	<b>CHH303</b>	Organic Chemistry Lab- IV	Core Course Practical	0-0-4	2	Students will understand Isolation, characterization and estimation of proteins.
3	<b>CHH305</b>	Physical Chemistry V <i>Quantum Chemistry &amp; Spectroscopy</i>	Core Course	4-0-0	4	To identify the limitations of classical mechanics and the need of quantum chemistry.
4	<b>CHH307</b>	Physical Chemistry Lab- V	Core Course Practical	0-0-4	2	To provide the knowledge of spectroscopy and colourimetry.
<b>Discipline Specific Elective</b>						
	<b>CHH309</b>	Application of computers in Chemistry	<b>DSE I</b>	4-0-0	4	To enhance knowledge on application of computer in chemistry.
	<b>CHH311</b>	Application of computers in Chemistry- Lab	<b>DSE I</b>	0-0-4	2	To learn use of computer Software like Scilab and Excel, etc for data handling and manipulation.
OR						
	<b>CHH313</b>	Analytical Methods in Chemistry	<b>DSE I</b>	4-0-0	4	To make student aware of the: Concept of sampling, Accuracy, Precision, Statistical test data-F, Q and t test.

	<b>CHH315</b>	Analytical Methods in chemistry- Lab	<b>DSE I</b>	0-0-4	2	To impart detail knowledge of latest instrumentation techniques and detect analytes in a mixture.
<b>Discipline Specific Elective</b>						
	<b>CHH317</b>	Industrial Chemicals and Environment	<b>DSE 2</b>	4-0-0	4	To enhance the knowledge of different industrial chemicals, gases and their effect on environment.
	<b>CHH319</b>	Industrial Chemicals and Environment- Lab	<b>DSE 2</b>	0-0-4	2	To enhance the skill of determination of air and water quality parameters.
<b>OR</b>						
	<b>CHH321</b>	Novel Inorganic Solids	<b>DSE 2</b>	4-0-0	4	To give in depth knowledge of Solid-state chemistry and material chemistry.
	<b>CHH323</b>	Novel Inorganic Solids- Lab	<b>DSE 2</b>	0-0-4	2	To learn determination of hydrogel by co-precipitation method and total difference of solids.
<b>SEMESTER VI</b>						
1	<b>CHH302</b>	Inorganic Chemistry IV <i>Organometallic Chemistry &amp; Bio-inorganic Chemistry</i>	Core Course	4-0-0	4	To impart in depth knowledge organometallic compounds and the basic principles of qualitative inorganic analysis.
2	<b>CHH304</b>	Inorganic Chemistry Lab- IV	Core Course Practical	0-0-4	2	To give detail knowledge on synthesize inorganic coordinate complexes by substitution method.
3	<b>CHH306</b>	Organic Chemistry V <i>Spectroscopy</i>	Core Course	4-0-0	4	To provide knowledge on organic compounds finding applications in everyday life and techniques for. IR, NMR and UV- Visible spectroscopy.
4	<b>CHH308</b>	Organic Chemistry Lab- V	Core Course Practical	0-0-4	2	To enhance knowledge on preparation and identification analysis of organic compounds.

Discipline Specific Elective						
	<b>CHH310</b>	<i>Polymer Chemistry</i>	<b>DSE 3</b>	4-0-0	4	To provide knowledge on the synthesis, properties and applications of polymers.
	<b>CHH312</b>	Polymer Chemistry DSE-3 Lab	<b>DSE 3</b>	0-0-4	2	To enhance fundamental knowledge on synthesis of different polymers.
OR						
	<b>CHH314</b>	<i>Green Chemistry</i>	<b>DSE 3</b>	4-0-0	4	To learn about protection of environment with the concept application of green chemistry.
	<b>CHH316</b>	Green Chemistry- Lab	<b>DSE 3</b>	0-0-2	2	To explore Alternative sources of energy like microwave assisted one pot synthesis of phthalocyanine complex of copper (II).
Discipline Specific Elective						
	<b>CHH318</b>	<i>Molecular Modelling and Drug Designing</i>	<b>DSE 4</b>	4-0-0	4	To make students learn the theoretical background of principles of computational techniques in molecular modelling, evaluation and applications
	<b>CHH320</b>	Molecular Modelling and Drug Designing- Lab	<b>DSE 4</b>	0-0-4	2	To provide knowledge of the structures and shapes of organic molecules using the software; ChemSketch, ArgusLab ( <a href="http://www.planaria-software.com">www.planaria-software.com</a> ) etc.
OR						
	<b>CHH322</b>	<i>Inorganic material and Industrial importance</i>	<b>DSE 4</b>	4-0-0	4	Students learn about silicates, fertilizers, surface coatings, batteries, engineering materials for mechanical construction

						and nano-sized materials.
4	<b>CHH324</b>	Inorganic material and Industrial importance- Lab	<b>DSE 4</b>	0-0-4	2	To Estimate Calcium and phosphoric acid in different fertilizer.
Total Credit						148

<b>Program Name</b>		<b>PG Diploma in Polyurethane Technology [Industry-Academia collaborative Program]</b>		
<b>Objective</b>		The course will provide an excellent platform for students for industry academy interaction and placement in the polyurethane industry as a better carrier option.		
<b>Semester I [Credits=20]</b>				
<b>S. N.</b>	<b>Code</b>	<b>Course Name</b>	<b>Category</b>	<b>Objectives</b>
1.	PU101	Chemistry of Polymers	Core Course	The provide fundamental and basic concept of polymer, structure-property relationship, classification and types of polymerization
3	PU103	Polyurethane Chemistry	Core Course [Industry]	To impart in-depth knowledge of basic chemistry of polyurethane with its structure and properties.
4	PU105	Polyurethane Processing Technology-I	Core Course [Industry]	To provide detail concept of different synthesis techniques of polyurethane and they have to finalise a suitable techniques for better product formation.
5	PU107	Application of Polyurethanes	Core Course [Industry]	To impart in-depth knowledge of polyurethane application in the industry.
6	PU109	Entrepreneurship, Quality and Environment	[Industry]	To make students know about the environmental impact of used raw material, quality of the final product and idea about different aspects of entrepreneurship given to the students.
7	PU111	Testing-Standards-Characterization	[Industry]	To make Students aware of the standard process of testing like Indian standard (IS) or ASTM for mechanical and chemical properties of the final product.
		Total Credits		20