

Program Outcome – CHEMISTRY

Prepare students of for prominent career in industries, research institutes, and academics and for higher studies within India and abroad. Students will demonstrate specific understanding of major concepts in all core subjects of Physical Chemistry along with feasible level of understanding in rest of chemistry.

Physical Chemistry

Program Specific Outcome-

The program specific outcome is - to create, select and apply appropriate techniques, resources and modern technology in multidisciplinary environment. Further A research oriented learning that develops analytical and integrative problem-solving approaches. Also to get hands on various advance techniques with laboratory skills on preparation of various solutions, design of some reactions with its work up and isolation.

Course Outcome-

Course Number and Name	Course outcome
CHEM-101 Physical Chemistry I	Students are taught following topics: Thermodynamics, phase equilibria, Quantum Chemistry, and Chemical Kinetics. These topics will help students to understand the physical properties of chemical reaction.
CHEM-105	Gets practical knowledge to design experiments, analyze and interpret data so as to reach to valid conclusions using instrumental methods.
CHEM-201 Physical Chemistry I	Students get familiar with Thermodynamics, Electrochemistry, Quantum Chemistry, and Chemical Kinetics, which helps to put these principals and fundamentals in actual research and practical's
CHEM-205	Due to importance and essentiality of 'Physical Chemistry' in each branch of Sciences – shows usage of subject fundamentals-principals with practical knowledge to design experiments, analyze and interpret data so as to reach to valid conclusions.
CHEM--311: Solid State Chemistry	In the present topic, students are taught methods of synthesis of solid materials, electrical properties, magnetic properties, dielectric properties, etc. This will help them to design solid particles of desired properties.

CHEM-312 Spectroscopy	Complete knowledge about spectroscopy method which is essential part of the chemistry
CHEM-313 Statistical thermodynamics, Thermodynamics of biochemical systems and electrochemistry I	Students come to know about statistical thermodynamics, thermodynamics of biological systems and electrochemistry which they can go through in real sense.
CHEM 314 Practical	Due to importance and essentiality of 'Physical Chemistry' in each branch of Sciences – shows usage of subject fundamentals-principals with practical knowledge to design experiments, analyze and interpret data so as to reach to valid conclusions.
CHEM 316 Elective I	Gets research motivation from this particular paper
CHEM 317 Elective II	
CHEM-411 Atomic structure, Group theory and Chemical Bonding	In this paper students get familiar with nature of chemical bonding, knowledge about symmetry and its operation with structure of atoms.
CHEM-412 Electrochemistry II	In this present topic students get the knowledge of functioning of various sensors, electrochemical techniques and various types of batteries.
CHEM-413-Photo-Chemistry	In the present topic, students are taught fundamental aspects of photo-chemistry, selection rules for photo-physical process, photo-chemical reaction and application. This topic will help students to understand how one can harvest photonic energy for performing chemical reactions.
CHEM-416- Project	Students gets practical as well as theoretical knowledge related to concern topic with analysis of results

Inorganic Chemistry

Program Specific Outcome-

The specific outcome of this course is to enable students to acquire sufficient knowledge and skills related to Inorganic chemistry. The course also offers a blend of various interdisciplinary subjects so that students can compete in various career fields.

Course Outcome-

Course Number and Name	Course outcome
CHEM-102 Inorganic Chemistry I	Students are taught following topics: Inorganic Reaction Mechanisms, Organometallic Chemistry, Chemical Bonding and Chemical Reactivity. These topics help students to acquire advanced knowledge about Inorganic Chemistry.
CHEM-106: Inorganic Chemistry Practical-1	Students get practical knowledge on planning and performing experiments for synthesizing inorganic complexes.
CHEM-202 Inorganic Chemistry II	Students get familiar with advanced and applied areas viz., Solid State Chemistry, Nanomaterials, Molecular Symmetry, Group theory, Environmental Chemistry and Bioinorganic Chemistry.
CHEM-206: Inorganic Chemistry Practical-2	Students get practical knowledge on the analysis of ores and alloys.
CHEM--321: Solid State Chemistry-I	Students get familiar with Crystal Chemistry, Linked polyhedra, Synthesis of Inorganic Materials, Different methods for single crystal growth, Thin Film Preparation, Solid Solutions, Liquid Crystals, Crystal defects and non-stoichiometry. This enables students to understand the basics of solid state chemistry and preparation of solids..
CHEM-322: Coordination and Bio-Inorganic Chemistry	Students get familiar with Inorganic Photochemistry, Magnetic properties of complexes, Electronic spectra of complexes and Bio-Inorganic Chemistry which are important topics for NET/SET examination.
CHEM-323: Instrumental methods and spectroscopy	Students get to learn various instrumental techniques viz., X-ray Diffraction, Electron Diffraction, Neutron diffraction, Electron spin resonance spectroscopy, Mössbauer Spectroscopy that helps them in characterizing new materials.
CHEM 324: Advances in Inorganic Chemistry (Elective -I)	This topic includes basic and detail information about chemistry of group 13, 14, 15, 16 and 17 elements. Focus is also on preparation of coordination compounds, Stereochemistry, Chirality and Fluxionality of coordination compounds, Crystal Engineering: Metal organic frameworks (MOFs), Metallurgy. Students get exposed not only to basic

	topics but also some advanced topics in Inorganic chemistry.
CHEM-325: Applied Inorganic Materials (Elective-II)	The paper includes specialized topics related to industrial applications viz., inorganic materials, supramolecular chemistry, fertilizers and nutrients, Glass, Paints and pigments, Zeolites: synthesis, and various miscellaneous topics of industrial importance. These are very important topics from industrial point of view.
CHEM 326: Separation and estimation of metal ions, Analysis of the commercial samples	Students get practical knowledge on the analysis of various commercial samples e.g., Separation and estimation of metal ions from drugs, soil, cement, salts etc.
CHEM 327: Coordination Chemistry, Synthesis and characterization of Inorganic compounds and materials.	Students get practical knowledge on synthesis and characterization of inorganic complexes which helps them to apply theoretical knowledge gained in performing and analyzing different synthetic experiments.
CHEM-421 Solid state chemistry-II	The paper focuses on studying the properties and applications of different materials. Different properties viz., Electrical, Magnetic, Thermal, optical and size/dimensions of solids are included in detail.
CHEM-422 Organometallic chemistry and catalysis	The topics viz., Organometallic Chemistry of p- and f-block elements and their role in catalysis are taught in detail which prepares students in understanding the mechanism and applications of various reaction processes.
CHEM-423 Instrumental methods, spectroscopy and group theory	Specialized and basic spectroscopic and microscopic techniques are taught e.g, Infrared spectroscopy, Raman spectroscopy, Nuclear Magnetic Resonance spectroscopy, Microscopy for surface chemistry Thermal and Optical Methods of Analysis along with Applications of Group theory. These topics help the students in understanding the basic principle and applications of different characterizing techniques.
CHEM-424- Project	Students get practical as well as theoretical knowledge related to concern topic with analysis of results. This also improves the research aptitude of students.

Organic Chemistry

Program Specific Outcome-

The program specific outcome of this course is to enable students to acquire knowledge and skills and develop analytical approach for problem solving. The learned techniques are used to create, select and apply knowledge, resources and modern technology in multidisciplinary environment. Also to get hands on various advance techniques with laboratory skills on preparation of various solutions, design of some reactions with its work up and isolation.

Course Outcome- Organic Chemistry

Course Number and Name	Course outcome
CHEM-103 Organic Chemistry	Students are taught following topics: Physical Organic Chemistry, Stereochemistry, Methods of C-C bond formation using Carbonyl functions, Spectroscopy, These topics will help students to understand basics of organic chemistry and new approaches in the Organic Chemistry. while Spectroscopic techniques will help students for structural elucidation and spectral data interpretation.
CHEM-105 Practical	Gets practical knowledge of new organic techniques and to design experiments and valid conclusions using new preparation methods.
CHEM-203 Organic Chemistry	Students are taught with topics like Aromaticity, Elimination and Nucleophilic Substitution Reactions, Oxidation Reduction and Reaction and Rearrangments, which helps them to analyse and to put these principals and fundamentals in actual research and practicals.
CHEM-207 Practical	Due to wide industrial and academic scope of organic Chemistry and its essentiality usage of subject fundamentals-principals with practical knowledge to design experiments, analyze and interpret data so as to reach to valid conclusions.
CHEM-331: Photochemistry, Stereochemistry, Physical Organic, Chemistry	In the present topic, students are taught methods of Chiral synthesis, New Chiral Techniques, Photochemical processes, This will help them to understand new area of research.
CHEM-332 Ylids, Radicals and Organometallic Chemistry	These topics covers important area of organic chemistry which gives various ideas in recent development in synthetic organic chemistry.

CHEM-313 Heterocyclic Chemistry and Advanced Spectroscopic Techniques.	Topics includes basics and advanced area of heterocyclic chemistry which help them to use their knowledge in the recent development in this area, knowledge of new Spectroscopic techniques gives them structural identification and use of various techniques in their spectral interpretation of their research problems.
CHEM 314 Practical	Due to wide industrial and academic scope of organic Chemistry and its essentiality usage of subject fundamentals-principals with practical knowledge to design experiments, analyze and interpret data so as to reach to valid conclusions
CHEM 316 Elective I	Gets research motivation from this particular paper
CHEM 317 Elective II	
CHEM-431: Stereochemistry, Asymmetric Synthesis, Theoretically Fascinating molecules, Organic electronic and photonic materials.	In this paper students get familiar with detailed study of various chiral synthetic techniques and designing of chiral molecules and chiral catalyst. this paper also covers today's recent advances in solar cell chemistry like dye sensitized solar.
CHEM-432 Advanced Synthetic organic chemistry	In this present topic students get the knowledge of design of new domino reactions and also get familiar with new techniques of retrosynthesis which help them in research modifications.
CHEM 433 Green Chemistry	Students gets knowledge of today's demanding area of research i.e. Ecofriendly research called green synthesis.
CHEM-437 Research Project	Students gets practical as well as theoretical knowledge related to concern topic with analysis of results

Analytical Chemistry

Program Specific Outcome-

The program specific outcome is - to create, select and apply appropriate techniques, resources and modern technology in multidisciplinary environment. Further a research oriented learning that develops analytical and integrative problem-solving approaches. Also to get hands on various advance techniques with laboratory skills on preparation of various solutions, design of some reactions with its work up and isolation.

Course Outcome

Course Number and Name	Course outcome
CHEM-104:Analytical Chemistry I	<p>On completion of the course, students will be able to classify the analytical methods; select a method for analysis based on performance; understand the basics of electromagnetic spectrum, type of transitions and components of optical instruments; learn the details of atomic absorption spectrometry and its applications to biological and environmental samples.</p> <p>The students are learn applications of UV-Visible spectroscopy for the quantitative determination of trace metals in food, blood and urine samples. In AES, construction and working of plasma sources and their applications in geological, metallurgical, food, agricultural, environmental and biological samples. In IR, the concept of Fourier Transform spectroscopy, various instrumentation like dispersive, non-dispersive and FT-types of instruments and their uses in the detection of CO and CO₂ in the atmosphere.</p> <p>The extraction mechanism in transport of metal from aqueous phase in liquid-liquid extraction, the extraction equilibria and hence parameters favouring extraction in chelate extraction system and the of sorbents used in solid phase extraction are learnt by students. They gain knowledge regarding the theoretical aspects involving chromatography and understand concepts related to the efficiency in separation.</p> <p>This course covers all the practical theory the students need to know about principle, working of Gas Chromatography and High Performance Liquid Chromatography techniques including discussion on carrier gas/liquid supply, sample introduction on-column and injection techniques; analytical columns; detectors, mode of separation and applications in various fields with examples.</p>

CHEM-108	Students gain knowledge about the non-instrumental techniques redox reactions, complexometric reactions, quantitative determination of metals in mixture, nitro group in organic compounds, ascorbic acid in food products, Manganese in ore and capacity of cation exchange resin.
CHEM-204: Analytical Chemistry II	<p>This module provides an introduction to the measurement technique of Ion selective potentiometry. It is intended to be a primary learning tool for a student in a Quantitative Analysis of analytes using solid state, precipitate and liquid-liquid membrane, enzyme and gas sensing electrodes with applications. Also, this course summarizes the basic concepts of modern voltammetric techniques of analysis in studies of the electrochemical properties of compounds and systems and the theory describes thermodynamics and kinetics of electrochemistry. The advantages and disadvantages of voltammetric techniques like DPP, CV and Stripping voltammetry of analysis are briefly described.</p> <p>Students are learn the basic concepts and instrumentation of ^1H, ^{13}C, ^{19}F, ^{31}P NMR and Mass Spectrometry and the applications of these instruments in various fields like pharma, medical, academia and research. Similarly X-ray and ESCA techniques principles, instrumentation and applications.</p>
CHEM-208	<p>The students learn the use of instrumental methods for analysis, spectrophotometer, colorimeter, flame photometer, and pH meter based experiments are adopted for sample analysis.</p> <p>The students learn the simultaneous determination of Cr and Mn, quantitative analysis of glucose, nitrites, silica and Li/K by flame photometry and sodium benzoate by pH metry.</p>
CHEM-341: Separation Techniques	Students gain knowledge about importance of sample preparation method and the use of separation techniques for analysis of complex material. Familiarize with the uses of methods based on solvent extraction, supercritical fluid extraction, solid phase micro extraction and membrane separation. Gain knowledge about the practical aspects and applications of ion exchange chromatography and ion chromatography, size exclusion chromatography and supercritical fluid chromatography.
CHEM-342: Spectroscopic Techniques	The students gain more knowledge about the concepts of IR, Raman, NMR, Mass, and ESR spectroscopic techniques and how to apply the learned concepts of these techniques for spectral interpretation. This helps to find out the structure of synthesized unknown organic compounds.
CHEM-343: Electrochemical Techniques Sensors And Environmental Management	To make students to understand the concepts behind the Voltammetry, Polarography, Chronotechniques and its applications in analysis of various kinds of organic,

	inorganic and biological materials. Also, study the working principle, instrumentation of many types of Chemical sensors and their applications in environmental monitoring, food quality control, clinical chemistry, forensic science etc.
CHEM 346: Analytical Chemistry Practical III	The students learn analysis of organic compounds, medicinal products, food products, detergent, Biochemical and analysis of substances by electroanalytical methods like potentiometry and cyclic voltammetry.
CHEM 347: Analytical Chemistry Practical IV	The students learn to analyse ilmenite, bauxite and stainless steel using standard methods. Use of ion exchange chromatography for separation of Zn and Cd. AAS for Zn analysis and HPLC as separation analytical tool.
CHEM 344: EC-I -Special Topics In Analytical Chemistry-I	
CHEM 345: EC-II- Special Topics In Analytical Chemistry-II	<p>Students were introduced to principles and applications of radio analytical techniques like Instrumental and radio chemical neutron activation analysis, Isotope dilution methods, radiometric titrations and radio release methods. Scope of these methods in various fields was outlined. Principles and applications of gamma radiography in industrial field was discussed. Principles, instrumentation and applications of advanced thermal methods like simultaneous TG - DTA/ DSC and evolved gas analysis using TG coupled to gas chromatography, Mass spectrometer and FTIR were introduced along with relevant applications in different fields.</p> <p>Students learn the 12 principles of green chemistry, atom economic and uneconomic reactions. Physical, chemical and biological treatment for waste management. Homogeneous and heterogeneous catalysts, PTC, photocatalysts and biocatalysts, the concept of solvent free synthesis, supercritical fluid and ionic liquids as a catalysts and solvents in synthetic organic chemistry</p>
CHEM 441: Quality In Analytical Chemistry And Pharmaceutical Analysis	Students understand the significance of good laboratory practice, quality control and quality assurance in the chemical industry in general and analytical laboratory in particular. On completion of the course, they would develop the skill to practice and manage the selection of analytical techniques, sampling, data treatment, impurity profiling, documentation, audits, etc. in an analytical laboratory for total quality management.

	<p>The students will be well acquainted with the general idea of pharmaceutical industry, drug formulations and dosage forms with sources of impurities and its limit. The analyses of drugs substances by classical and instrumental methods of analysis that are required in pharmaceutical research are covered in this course. The practical applications of these instruments with examples are also illustrated to the students. The subject imparts the knowledge of drug development, pharmaceutical legislation and ISO standards in student.</p>
CHEM 442: Advanced Instrumental Techniques And Nanotechnology	<p>To learn the principle, instrumentation and applications of the advanced instrumental techniques like Electron spectroscopy: AUGER, Microprobe and Reflectance spectroscopy and Electron Microscopy techniques such as Scanning Electron microscopy, STM, AFM, Chemiluminescence, Photoacoustic and Polarimetry methods.</p> <p>To make the students to understand the concept of hyphenation and hyphenated techniques and the applications in the analysis of certain organic, inorganic samples also to learn the concept of Spectro-electrochemistry and radio-chromatography for the separation and estimation of complex compounds. Similarly, students also learn the nanotechnology in terms of synthesis, characterization, and applications of some nanomaterials.</p>
CHEM 443: Analysis Of Ores, Food, Agro /Agriculture	<p>In this course students get familiarized with the analysis of alloys, ores, and minerals, soil, fertilizers, food products and pesticides. Understand dissolution and use of standard procedures to determine the composition of alloys, ores/minerals; soil quality parameters. They are also expected to learn the processing of food product, its quality requirements and analysis for composition; additives and contaminants.</p>
CHEM-446- Project	<p>The students learn in this course the literature survey, planning of reactions synthesis and characterizations of synthesized compounds by various techniques and also develop an interest in the field of research.</p>

Industrial Polymer Chemistry

Master of Science in Industrial Polymer Chemistry ((IPC), a two year postgraduate program was started in 2017 with collaborative efforts of Department of Chemistry, University of Mumbai and Indian Rubber Manufacturers Research Association (IRMRA). The course provides theoretical as well as technical knowledge of polymers such as plastic, rubber etc. In addition, provides firsthand experience in compounding and testing of these polymers. Modification techniques for enhancing the use of these polymers are also part of this course. Testing involves raw polymer testing, compound testing and product testing by using physical and chemical test instruments such as UTM, Resilience tester, Abrasion resistance tester, ICP, GPC, FTIR, GC-MS, Acetone extraction, TGA, DSC etc. Course is designed such that both theoretical and practical sessions will get cover within the specified course time.

After completion of the course student will be able to answer questions related to-

- Introduction about polymers and its types
- Rheological properties of polymers
- Various rubber and its compounding ingredients
- Mixing and processing of rubbers
- Testing of polymers using physical and chemical methods

Each student is allocated with one research project which tests their level of understanding and allow them to face the challenges occur in polymer industries and also it check the level of their problem solving ability.

Course Specific Outcome

SEMESTER III

Unit	Course Code and Name	<u>Outcome</u>
IPCHEM 351 BASICS OF POLYMERS, RUBBER AND ADDITIVES		
Unit I	Polymers & Polymerization Techniques	<ul style="list-style-type: none">• Introduction of polymers and their basic types• Different polymerization techniques for

		<p>manufacturing of polymers</p> <ul style="list-style-type: none"> • Classification of polymers on the basis of their structure and origin • Effect of different structure on properties of a polymer
Unit II	General Purpose Rubber	<ul style="list-style-type: none"> • Introduction of rubbers use for general-purpose applications such as Natural rubber, Styrene Butadiene rubber, Polybutadiene rubber and Polyisoprene rubber.
Unit III	Special Purpose Rubber	<ul style="list-style-type: none"> • Introduction of rubbers or blends use for special purpose applications such as NBR and Thermoplastic elastomers
Unit IV	Non-Rubber Additives	<ul style="list-style-type: none"> • This unit involves knowledge of compounding ingredients such as fillers, vulcanizing agents, processing aids etc., which are added in rubber to impart properties to the product.
IPCHEM 352 RHEOLOGY AND PROCESSING OF RUBBERS		
Unit I	Rheology of Rubbers	<ul style="list-style-type: none"> • Rheological behavior of rubber during processing and the instruments use for measuring rheological properties.
Unit II	Compounding & Mixing Techniques	<ul style="list-style-type: none"> • Introduction to basic compounding of rubber to convert it into a product • Mixing of compounding ingredients into rubber, mastication and its effect on final quality of the batch • Machineries use for mixing, their working and mixing properties
Unit III	Post compounding Processing	<ul style="list-style-type: none"> • Introduction of various processes takes place after mixing such as calendaring and extrusion for making sheets and profile • Working of extruders, different types of

		<p>extruder available for various purposes and their limitations.</p> <ul style="list-style-type: none"> • working of calendars, different types of calender available for various purposes and their limitations.
Unit IV	Molding & Vulcanizing techniques	<ul style="list-style-type: none"> • Introduction to mold design and various molding process. • Blanks & pre-heating techniques, preparation of surfaces for bonding. • Curing: Autoclaves, Hot air chambers, curing of built up articles, continuous vulcanization, L.C.M. (Liquid Curing Media), Fluidized Bed, microwave curing. Hand building and forming equipment for tank, pipe lining, roller covering. Troubleshooting.
Unit V	Finishing of Rubber Products	<ul style="list-style-type: none"> • This unit involves introduction of methods, which are involved in removing flash from the final product.

IPCHEM 353

TESTING OF RUBBER ALLIED MATERIALS & COMPOSITES

Unit I	Principles of Testing & Raw Material Testing	<ul style="list-style-type: none"> • Introduction to principles of testing, various standards for quality testing. • Various Instruments for characterization of polymers such as GPC, FTIR, UV-Vis spectrometer, ICP, DSC etc.
Unit II	Testing of Raw Rubber & Unvulcanized Rubber Compound	<ul style="list-style-type: none"> • Viscosity Characterization by using viscometers • Testing of rubber sample by using MDR, RPA, PRI etc.
Unit III	Testing of Vulcanizate	<ul style="list-style-type: none"> • Mechanical testing of vulcanizate such as hardness, tensile, abrasion etc. • Characterization of rubber compound by using thermal analysis techniques TGA,

		DSC, TMA etc.
Unit IV	Process & Quality Control	<ul style="list-style-type: none"> • Weather properties, heat buildup, flex test, DMA, RPA etc. • Testing of rubber products such as hoses, gaskets, belts, tubes, bearings, V-belts and Mounts etc.
IPCHEM 356 EC-I <u>BIOPOLYMERS & BIO COMPOSITES</u>		
Unit I	Biopolymers & Biodegradation	This unit deals with basic of biopolymers and its degradation mechanism
Unit II	Characterization & Testing For Biodegradability	This unit deals with methods and standards for bio-degradable plastics and test method with bio-degradability
Unit III	Biocomposite	This unit deals with type of bio-composites and their properties
Unit IV	Applications o f Bioploymers	This unit deals with applications of bio-polymers and their properties particularly bio-sensors; bio films
IPCHEM 357 EC-II POLYMER NANO COMPOSITES		
Unit I	Composites	<ul style="list-style-type: none"> • This unit deals with the composites of polymers, their advantages and disadvantages. Polymer matrices - thermoplastics and thermosetting plastics • Nanofiber reinforcement and its effect- Short and long fibers
Unit II	Nanomaterials used in Polymers	<ul style="list-style-type: none"> • Introduction to Nano fillers, their types and its modifications • Electrospinning technique for production of Nano fillers • Characterization techniques for Nano structured materials such as AFM, SEM
Unit III	Carbon Nanotubes & their	<ul style="list-style-type: none"> • Preparation of CNTs, different type of

	applications	<p>CNTs, its properties and applications.</p> <ul style="list-style-type: none"> • Nanotube alignment and characterization
Unit IV	Preparation & Application of Polymer Nano composites	<ul style="list-style-type: none"> • Nanocomposites synthesis process by in-situ polymerization, melt blending and solution blending • Polymers in nanoelectronics, Magnetic polymer nanocomposites, Wear resisting polymer nanocomposites, Packaging, Bio-medical, surface coatings, etc.
<p>IPCHEM 354 & 355</p> <p>INDUSTRIAL POLYMER CHEMISTRY PRACTICAL- I & II</p> <p>These two experimental papers provide the basic understanding of rubber technology along with hands-on experience on various instruments used for rubber testing and characterization.</p>		

SEMESTER IV

IPCHEM 451	DESIGN & DEVELOPMENT OF RUBBER PRODUCTS	
Unit I	Formulation Design of Rubber Compounds	<ul style="list-style-type: none"> • Basics of compounding • Selection of rubber and other ingredients • Rubber compound formulation for general purposes and for special purpose such as oil resistance, flame resistance, heat resistance etc.
Unit II	Design & Development of Tyres	<ul style="list-style-type: none"> • Introduction to different components of tyre • Compounding of different components of tyres • Tyre processing techniques
Unit III	Conveyor Belt Technology	<ul style="list-style-type: none"> • Introduction to different types of conveyor belts • Mixing, compounding and calendaring • Building of conveyor belt • Finishing and packaging • V-belt building
Unit IV	Product Development of Hoses	<ul style="list-style-type: none"> • Introduction to different kind of hoses • Reinforcement

		<ul style="list-style-type: none"> • Autoclave curing of hoses
IPCHEM 452 <u>LATEX SCIENCE AND ADHESIVES</u>		
Unit I	Latex Science	The unit deals with basics of rubber latex , its classification and characterization.
Unit II	Latex Application	The unit deals with application of rubber latex like foam, dipped products and threads.
Unit III	Rubber Based Adhesives	The unit deals with usage of different type of rubbers in adhesive application
Unit IV	Resin Based Reactive Adhesives	The details of resin based adhesives with its applications and characterization are dealt in this unit.
IPCHEM 453 TYRE SCIENCE AND TECHNOLOGY		
Unit I	Tyre Structure	Basic of tyre technology including history and composition of tyre are dealt in this unit
Unit II	Tyre Carcass And Building	Manufacturing of various tyre components are discussed in this unit
Unit III	Tyre Wear Frictioning and Noise	The wear and tear of tyres , their cause and effects are discussed in this unit
Unit IV	Testing of Tyre	Various test and norms related to tyre are discussed in this unit.
IPCHEM 454 RESEARCH PROJECT		
<p>The students perform research project in guidance of their mentor on various topic related to industrial requirements, problems, ideas and innovations. This helps students to perform customized experiments to get desired but novel outputs and eventually enhances their ability to conduct independent research and technological development.</p>		

OPTIONAL COURSE

CHEM 4 OC I	This part of optional course provides the knowledge to the students about Intellectual properties, geographical indications, introduction to cheminformatics and applications. This paper makes the students aware about IPR and filling of IPR for the protection of their novel ideals within and outside India.
Intellectual Property Rights and Chem informatics	
CHEM 4 OC II	The paper includes specialized topics related to research methodology such as print,

Research Methodology	data analysis, methods of scientific research and writing scientific papers and chemical safety and ethical handling of chemicals. As this optional course creates good confidence among the students regarding the research of good quality with innovative ideas. Further students can get idea about writing of papers with data analysis and many more.
---------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------