

## SUBJECT: CHEMISTRY

### Purpose of the Program

The purpose of the undergraduate chemistry program at the university and college level is to provide the key knowledge base and laboratory resources to prepare students for careers as professionals in various industries and research institutions.

### Program's Outcomes

1. Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in analytical, Inorganic, Organic and Physical Chemistries.
2. Students will be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.
3. Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
4. Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
5. 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 and medicine.
6. Students will be able to explain why chemistry is an integral activity for addressing social, economic, and environmental problems.
7. Students will be able to function as a member of an interdisciplinary problem solving team.

<b>PROGRAM SPECIFIC OUTCOMES (PSOS)</b>	
<b>CERTIFICATE IN BIOORGANIC AND MEDICINAL CHEMISTRY</b>	
<b>First Year</b>	Certificate in Bioorganic and Medicinal Chemistry will give the student a basic knowledge of all the fundamental principles of chemistry like molecular polarity , bonding theories of molecules, Periodic properties of more than 111 elements, mechanism of organic Reactions, Stereochemistry, basic mathematical concepts and computer knowledge, chemistry of carbohydrates, proteins and nucleic acids: medicinal chemistry, synthetic polymers, synthetic dyes, Student will be able to do to qualitative quantitative and bio chemical analysis of the compounds in the laboratory. This certificate course is definitely going to prepare the students for various fields of chemistry and will give an insight into all the branches of chemistry and enable our students to join the knowledge and available opportunities related to chemistry in the government and private sector services particularly in the field of food safety, health inspector, pharmacist etc. Have a broad foundation in chemistry that stresses scientific reasoning and analytical problem solving with a molecular perspective.
<b>Second Year</b>	<b>DIPLOMA IN CHEMICAL DYNAMICS AND ANALYTICAL TECHNIQUES</b>
	<b>Diploma in Chemical Dynamics and Analytical Techniques</b> will provide the theoretical as well as practical knowledge of handling chemicals, apparatus, equipment and instruments. The knowledge about feasibility and velocity of chemical reactions through chemical kinetics, chemical equilibrium ,phase equilibrium, kinetic theories of Gases ,solid and liquid states, coordination chemistry, metal carbonyls and bioinorganic will enable the students to work as chemists in pharmaceutical industries. The knowledge about atomic structure, quantum mechanics, various spectroscopic tools and separation technique will make the students skilled to work in industries: Achieved the skills required to succeed in the chemical industry like cement industries, agro product, paint industries, rubber industries, petrochemical industries, food processing industries, Fertilizer industries, pollution monitoring and control agencies etc. Got exposures of a breadth of experimental techniques using modern instrumentation Learn the laboratory skills and safely measurements to transfer and interpret knowledge entirely in the working environment. monitoring of environment issues: monitoring of environmental pollution problems of atmospheric sciences, water chemistry and soil chemistry and design processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

Third Year	DEGREE IN BACHELOR OF SCIENCE
	<p>Degree in Bachelor of Science programme aims to introduce very important aspects of modern day course curriculum, namely, chemistry of hydrocarbons, alcohols, carbonyl compounds, carboxylic acids, phenols, amines, heterocyclic compounds, natural products main group elements, qualitative analysis, separation techniques and analytical techniques. It will enable the students to understand the importance of the elements in the periodic table including their physical and chemical nature and role in the daily life and also to understand the concept of chemistry to inter relate and interact to the other subject like mathematics, physics, biological science etc.</p> <ul style="list-style-type: none"> <li>• Upon completion of a degree, chemistry students are able to employ critical thinking and scientific inquiry in the performance, design, interpretation and documentation of laboratory experiments, at a level suitable to succeed at an entry-level position in chemical industry or a chemistry graduate program</li> <li>• Various research institutions and industry people in the pharmaceuticals, polymers, and food industry sectors will surely value this course.</li> </ul>

**Semester-1,  
Paper-1 (Theory)  
Course Title: Fundamentals of Chemistry**

<b>Programme/Class: Certificate in Bioorganic and Medicinal Chemistry</b>	<b>Year: First</b>	<b>Semester: First</b>
Paper-1 Theory	Subject: <b>Chemistry</b>	
Course Code: B020101T	<b>Course Title: Fundamentals of Chemistry</b>	
<p><b>Course outcomes:</b> There is nothing more fundamental to chemistry than the chemical bond. Chemical bonding is the language of logic for chemists. Chemical bonding enables scientists to take the 100-plus elements of the periodic table and combine them in myriad ways to form chemical compounds and materials. Periodic trends, arising from the arrangement of the periodic table, provide chemists with an invaluable tool to quickly predict an element's properties. These trends exist because of the similar atomic structure of the elements within their respective group families or periods, and because of the periodic nature of the elements. Reaction mechanism gives the fundamental knowledge of carrying out an organic reaction in a step-by-step manner. This course will provide a broad foundation in chemistry that stresses scientific reasoning and analytical problem solving with a molecular perspective. Students will gain an understanding of</p> <ul style="list-style-type: none"> <li>• Molecular geometries, physical and chemical properties of the molecules.</li> <li>• Current bonding models for simple inorganic and organic molecules in order to predict structures and important bonding parameters.</li> <li>• The chapter Recapitulation of basics of organic chemistry gives the most primary and utmost important knowledge and concepts of organic Chemistry.</li> <li>• This course gives a broader theoretical picture in multiple stages in an overall chemical reaction. It describes reactive intermediates, transition states and states of all the bonds broken and formed. It enables to understand the reactants, catalyst, stereochemistry and major and minor products of any organic reaction.</li> <li>• It describes the types of reactions and the Kinetic and thermodynamic aspects one should know for carrying out any reaction and the ways how the reaction mechanism can be determined.</li> <li>• The chapters Stereochemistry gives the clear picture of two-dimensional and three-dimensional structure of the molecules, and their role in reaction mechanism.</li> </ul>		

**Semester-I, Paper-2 (Practical)**  
**Course Title: Quantitative Analysis**

<b>Programme: Certificate in Bioorganic and Medicinal Chemistry</b>	Year: First	Semester: I
<b>Practical paper-2</b>		Subject: Chemistry
Course Code: B020102P	<b>Course Title: Quantitative Analysis</b>	
<p><b>Course outcomes:</b></p> <p>Upon completion of this course the students will have the knowledge and skills to: understand the laboratory methods and tests related to estimation of metals ions and estimation of acids and alkali contents in commercial products.</p> <ul style="list-style-type: none"> <li>• Portability tests of water samples.</li> <li>• Estimation of metal ions in samples</li> <li>• Estimation of alkali and acid contents in samples</li> <li>• Estimation of inorganic salts and hydrated water in samples</li> </ul>		

**Semester-II Paper-1**  
**Course Title: Bioorganic and Materials Chemistry**

Programme: Certificate in Bioorganic and Medicinal Chemistry	Year: 1	Semester: II
Paper-1	Elective	Subject: Chemistry
Course Code: B020201T	<b>Course Title: Bioorganic and Medicinal Chemistry</b>	
<p><b>Course outcomes:</b> Biomolecules are important for the functioning of living organisms. These molecules perform or trigger important biochemical reactions in living organisms. When studying biomolecules, one can understand the physiological function that regulates the proper growth and development of a human body. This course aims to introduce the students with basic experimental understanding of carbohydrates, amino acids, proteins, nucleic acids and medicinal chemistry. Upon completion of this course students may get job opportunities in food, beverage and pharmaceutical industries.</p>		

**Semester-II, Paper-2 (Practical)**  
**Course Title: Biochemical Analysis**

Programme: Certificate in Bioorganic and Medicinal Chemistry	Year: 1	Semester: II
Subject: Chemistry		
Course Code: B020202P	Course Title: Biochemical Analysis	
<p><b>Course outcomes:</b></p> <p>This course will provide basic qualitative and quantitative experimental knowledge of biomolecules such as carbohydrates, proteins, amino acids, nucleic acids drug molecules. Upon successful completion of this course students may get job opportunities in food, beverage and pharmaceutical industries.</p>		

**Semester III, Paper-1 (Theory)****Course Title: Chemical Dynamics & Coordination Chemistry**

Programme: Diploma in Chemical Dynamics and Analytical Techniques	Year: Two	Semester: III
Paper-1 Theory	Subject: Chemistry	
Course Code: B020301T	<b>Course Title: Chemical Dynamics &amp; Coordination Chemistry</b>	
<p><b>Course outcomes:</b> Upon successful completion of this course students should be able to describe the characteristic of the three states of matter and describe the different physical properties of each state of matter. kinetic theory of gases, laws of crystallography, liquid state and liquid crystals, conductometric, potentiometric, optical methods, polarimetry and spectrophotometer technique to study Chemical kinetics and chemical equilibrium. After the completion of the course, Students will be able to understand metal- ligand bonding in transition metal complexes, thermodynamic and kinetic aspects of metal complexes.</p>		

**Semester III, Paper-2 (Practical):****Course Title: Physical Analysis**

Programme: Diploma in Chemical Dynamics and Analytical Techniques	Year: Two	Semester: III
Practical paper-2	Subject: Chemistry	
Course Code: B020302P	<b>Course Title: Physical Analysis</b>	
<p><b>Course Outcomes:</b> Upon successful completion of this course students should be able to calibrate apparatus and prepare solutions of various concentrations, estimation of components through volumetric analysis; to perform dilatometric experiments: one and two component phase equilibrium experiments.</p>		

**Semester IV Paper-1 (Theory)****Course Title: Quantum Mechanics and Analytical Techniques**

Programme: Diploma in Chemical Dynamics and Analytical Techniques	Year: Two	Semester: IV
Paper-1	Elective	Subject: Chemistry
Course Code: BO20401T	<b>Course Title: Quantum Mechanics and Analytical Techniques</b>	
<p><b>Course Outcomes::</b> Upon successful completion of this course students should be able to describe atomic structure, elementary quantum mechanics, wave function and its significance; Schrodinger wave equation and its applications; Molecular orbital theory, basic ideas – Criteria for forming molecular orbital from atomic orbitals, Molecular Spectroscopy, Rotational Spectrum, vibrational Electronic Spectrum: photo chemistry and kinetics of photo chemical reaction</p> <p>Analytical chemistry plays an enormous role in our society, such as in drug manufacturing, process control in industry, environmental monitoring, medical diagnostics, food production, and forensic surveys. It is also of great importance in different research areas. Analytical chemistry is a science that is directed towards creating new knowledge so that chemical analysis can be improved to respond to increasing or new demands.</p> <ul style="list-style-type: none"> <li>• Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.</li> <li>• Students will be able to function as a member of an interdisciplinary problem solving team.</li> <li>• Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems</li> <li>• Students will gain an understanding of how to determine the structure of organic molecules using IR and NMR spectroscopic techniques</li> <li>• To develop basic skills required for purification, solvent extraction, TLC and column chromatography</li> </ul>		

**Semester IV, Paper-2 (Practical)**  
**Course Title: Instrumental Analysis**

Programme: Diploma in Chemical Dynamics and Analytical Techniques	Year: Two	Semester: V
<b>Practical paper-3</b>		Subject: Chemistry
Course Code: B020402P	<b>Course Title: Instrumental Analysis</b>	
<p><b>Course outcomes:</b> Upon completion of this course, chemistry majors are able to employ critical thinking and scientific inquiry in the performance, design, interpretation and documentation of laboratory experiments, at a level suitable to succeed at an entry-level position in chemical industry or a chemistry graduate program.</p> <ul style="list-style-type: none"> <li>• Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.</li> <li>• Students will be able to function as a member of an interdisciplinary problem solving team.</li> <li>• Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems</li> <li>• Students will gain an understanding of how to determine the structure of organic molecules using IR and NMR spectroscopic techniques</li> <li>• To develop basic skills required for purification, solvent extraction, TLC and column chromatography</li> </ul>		

**Semester V, Paper-1 (Theory)**  
**Course Title: Organic Synthesis A**

Programme: Degree in Bachelor of Science	Year: Three	Semester: V
Paper-2 Theory	<b>Compulsory</b>	Subject: Chemistry
Course Code: B020501T	<b>Course Title: Organic Synthesis A</b>	
<p><b>Course outcomes:</b> Hydrocarbons are the principal constituents of petroleum and natural gas. They serve as fuels and lubricants as well as raw materials for the production of plastics, fibers, rubbers, solvents and industrial chemicals. This course will provide a broad foundation in for the synthesis of hydrocarbons. Hydroxy and carbonyl compounds are industrially important compounds The industries of plastics, fibers, petroleum and rubbers will specially recognize this course. Students will gain an understanding of which are used as solvents and raw material for synthesis of drug and other pharmaceutically important compounds.</p> <ul style="list-style-type: none"> <li>• Synthesis and chemical properties of aliphatic and aromatic hydrocarbons</li> <li>• Synthesis and chemical properties of alcohols, halides carbonyl compounds, carboxylic acids and esters</li> <li>• How to design and synthesize aliphatic and aromatic hydrocarbons.</li> <li>• How to convert aliphatic and aromatic hydrocarbons to other industrially important compounds</li> <li>• Functional group interconversion.</li> </ul>		

**Semester-V Paper-2**  
**Course Title: Rearrangements and Chemistry of Group Elements**

Programme: Degree in Bachelor of Science	Year: Three	Semester: V
Paper-2 Theory	<b>Elective</b>	Subject: Chemistry
Course Code: B020502T	<b>Course Title: Rearrangements and Chemistry of Group Elements</b>	
<p><b>Course outcomes:</b> This paper provides detailed knowledge of synthesis of various class of organic compounds and functional groups inter conversion. Organic synthesis is the most important branch of organic chemistry which provides jobs in production &amp; QC departments related to chemicals, drugs, medicines, FMCG etc. industries.</p> <ul style="list-style-type: none"> <li>• It relates and gives an analytical aptitude for synthesizing various industrially important compounds.</li> <li>• This paper also provides a detailed knowledge on the elements present in our surroundings, their occurrence in nature. Their position in periodic table, their physical and chemical properties as well as their extraction. This paper also gives detailed understanding of the s, p, d and f block elements and their characteristics.</li> </ul>		

**Semester V, Paper-3 (Practical)**  
**Course Title: Qualitative Analysis**

<b>Programme:</b> Degree in Bachelor of Science	Year: Three	Semester: V
<b>Practical paper-3</b>		Subject: Chemistry
Course Code: B020503P	<b>Course Title: Qualitative Analysis</b>	
<p><b>Course outcomes:</b> Upon completion of this course the students will have the knowledge and skills to: understand the laboratory methods and tests related to inorganic mixtures and organic compounds.</p> <ul style="list-style-type: none"> <li>• Identification of acidic and basic radicals in inorganic mixtures</li> <li>• Separation of organic compounds from mixture</li> <li>• Elemental analysis in organic compounds</li> <li>• Identification of functional group in organic compounds</li> <li>• Identification of organic compound</li> </ul>		

**Semester-VI Paper-1**  
**Course Title: Organic Synthesis B**

Programme: Degree in Bachelor of Science	Year: Three	Semester: VI
Paper-1 Theory	<b>Compulsory</b>	Subject: Chemistry
Course Code: B020601T	<b>Course Title: Organic Synthesis B</b>	
<p><b>Course outcomes:</b> This paper provides detailed knowledge of synthesis of various classes of organic compounds and functional groups inter conversion. Organic synthesis is the most important branch of organic chemistry which provides jobs in production &amp; QC departments related to chemicals, drugs, medicines, FMCG etc. industries.</p> <p>The study of natural products and heterocyclic compounds offers an excellent strategy toward identifying novel biological probes for a number of diseases. Historically, natural products have played an important role in the development of pharmaceutical drugs for a number of diseases including cancer and infection.</p> <ul style="list-style-type: none"> <li>• It relates and gives an analytical aptitude for synthesizing various industrially important compounds.</li> <li>• Learn the different types of alkaloids, &amp; terpenes etc. and their chemistry and medicinal importance.</li> <li>• Explain the importance of natural compounds as lead molecules for new drug discovery.</li> </ul>		

**Semester-VI Paper-2**  
**Course Title: Chemical Energetics and Radio Chemistry**

Programme: Degree in Bachelor of Science	Year: Three	Semester: VI
Paper-2 Theory	<b>Elective</b>	Subject: Chemistry
Course Code: B020602T	<b>Course Title: Chemical Energetics and Radio Chemistry</b>	
<p><b>Course outcomes:</b> Upon successful completion of this course students should be able to describe laws of thermodynamics and its applications, phase equilibria of one and two component system, electro chemistry, ionic equilibrium applications of conductivity and potentiometric measurements</p>		

**Semester VI, Paper-3 (Practical)**  
**Course Title: Analytical Methods**

<b>Programme:</b> Degree in Bachelor of Science	Year: Three	Semester: IV
<b>Practical paper-3</b>		Subject: Chemistry
Course Code: B020603P	<b>Course Title: Analytical Methods</b>	
<p><b>Course Outcomes:</b> Upon successful completion of this course students should be able to quantify the product obtained through gravimetric method; determination of <math>R_f</math> values and identification of organic compounds through paper and thin layer chromatography laboratory techniques: perform thermochemical reactions</p>		