

DEPARTMENT OF CHEMISTRY

SEMESTER PATTERN SYLLABUS	<i>Objectives</i>	The Outcomes of UG Course, B. Sc. in Chemistry At the completion of B. Sc. in Chemistry the students are able to:
<p>SUBJECT CHEMISTRY B.Sc. -I, Semester - I CH - 101: Paper- I (Inorganic Chemistry)</p> <p>Unit-I (A) Atomic structure (B) Periodic Properties:</p> <p>Unit-II (A) Covalent Bond (B) Ionic solids:</p> <p>Unit-III a) s- block elements b) Chemistry of Noble Gases:</p> <p>Unit-IV (A) p-block elements (B) Hydrides</p>	<p>1. State the fundamental assumptions of atomic theory and explain the composition of atoms, including electronic configuration.</p> <p>2. Describe the arrangement of elements in the periodic table and relate the arrangement to electronic configuration, bonding, and properties.</p> <p>1. Explain how ionic and covalent bonds are formed between atoms. Name molecular and ionic compounds and compare/contrast the properties of molecular and ionic compounds.</p> <p>2. Perform stoichiometric calculations involving conversions between molar and mass quantities of substances.</p> <p>1. To make student understand the modern periodic table which stand the backbone in understanding Chemistry and the periodic properties like Atomic and Ionic size Ionization Energy Electron Affinity Electro negativity and making student understand S Block elements in detail.</p> <p>2. Noble Gas Chemistry This portion of the curriculum is the one part of the periodic table which is not that much reactive which can be easily utilized in understanding the behavior of the inert gases.</p> <p>1. Predict variation in atomic radius, ionization enthalpy, and electron affinity and electro negativity with position in periodic table</p> <p>2. Describe specific reasons for variations of the above within a period and within a group</p>	<p>1. The purpose of the undergraduate chemistry program is to provide the key knowledge base and laboratory resources to prepare students for careers as professionals in the field of chemistry, and for professional school including medical, dental, law and business programs.</p> <p>2. To provide students with the skills required to succeed in graduate school, the chemical industry or professional school.</p> <p>3. To acquired the skills in handling scientific instruments, planning and performing in laboratory experiments</p> <p>4. Students will be skilled in problem solving, critical thinking drawing logical inferences and analytical reasoning as applied to scientific problems.</p> <p>5. Students will be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.</p> <p>6. To expose the students to a breadth of experimental techniques using modern instrumentation.</p> <p>7. Students will be able to clearly communicate the results of scientific work in oral, written and electronic</p>

<p>CH – 102 : Paper- II (Physical Chemistry) Unit-I Gaseous State</p>	<p>3. Predict relative bond strengths for compounds of a family of elements 4. Predict available oxidation states for s- and p-block elements.</p>	<p>formats to both scientists and the public at large.</p>
<p>Unit-II Solid State</p>	<p>1. State the assumptions of kinetic molecular theory of gases and use the gas laws to find the pressure, volume, temperature or amount of gas in a sample. 2. Explain what takes place during changes of state. Describe the characteristics of solids and liquids at the molecular level and the major intermolecular forces. 3. Discuss the properties of solutions. Calculate solution concentration in various units and perform stoichiometric calculations. 4. Formulate the first law of thermodynamics for closed systems and arrange the change in energy in the closed systems via heat and work transfer.</p>	<p>8. Students will be able to explore new areas of research in both chemistry and allied fields of science and technology. 9. 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.</p>
<p>Unit-III Liquid State</p>	<p>1. Students will be able to: Identify and describe properties of matter, including: flexibility, strength, transparency, hardness, water resistance, size, color, weight, and texture. Identify and describe three phases of matter: solid, liquid, and gas.</p>	<p>10. Students will be able to explain why chemistry is an integral activity for addressing social, economic, and environmental problems. 11. Students will be able to function as a member of an interdisciplinary problem solving team and learn professionalism, including the ability to work in teams and apply basic ethical principles.</p>
<p>Unit-IV Surface Chemistry and Catalysis</p>	<p>1. Understand the functioning of catalytic systems for chemical synthesis, with particular emphasis on catalysis at surfaces as it pertains to industrial reactions. 2. Develop detailed understanding of selected industrial catalytic processes. 3. Have a working understanding of the fundamental organic chemistry underlying many industrial synthetic processes.</p>	
	<p>1. Understand the structural basics of organic compounds. 2. Know the various types of organic reactions and their properties. 3. Recognize the importance of carbonyl and nitrogen containing</p>	

B.Sc. -I, Semester - II
CH - 201:
Paper- I
(Organic Chemistry)
Unit - I

- A) Structure and Bonding
B) Mechanism of Organic Reactions

Unit - II
Stereochemistry
Organic Compounds

of

Unit - III

- A) Alkanes
B) Alkenes

Unit - IV

- A) Dienes
B) Aromatic

compounds

1. Recognize and draw constitutional isomers, stereoisomers, including enantiomers and diastereomers, racemic mixture and meso compounds.
2. Know the fundamental principles of organic chemistry and predict outcomes and derive mechanism of various types of organic reactions.
3. Understand various types of reactive intermediates and factors affecting their stability.
4. Understand the nomenclature, synthesis, isomerism and physical properties of alkanes and cycloalkanes

1. Understand the concept of stereoisomerism.
2. Name the compound based on CIP nomenclature.
3. Apply the conformational analysis for the cyclic systems.

1. Name alkanes, alkenes, alkynes, cyclic hydrocarbons, and aromatics using IUPAC rules given the formula, structural formula, or abbreviated structural formulas.
2. Draw structural or abbreviated structural formulas for hydrocarbons given the name
3. Recognize basic organic functional groups and incorporate some of those groups into naming organic molecules
4. Explain the carbon-carbon single bond, double bond, and triple bond and the hybridization that occurs to achieve each.

1. Draw mechanisms for addition reactions or SN1 reactions proceeding through allylic cations.

compounds and Aromaticity	<ol style="list-style-type: none"> 2. Draw resonance structures for allylic cations, radicals, or anions. 3. Predict the products of Diels-Alder reactions, including stereochemistry; and when the dienophile is disubstituted. 4. Identify reactants involved in Diels-Alder reactions, allylic bromination reactions, and hydrogen halide additions to conjugated dienes. 	
CH – 202: Paper- II (Physical Chemistry) UNIT-I Thermodynamics	<ol style="list-style-type: none"> 1. Understand the concepts of thermodynamics and energy resources. 2. Classify the types of materials and their applications. 	
UNIT-II : Phase Equilibria	<ol style="list-style-type: none"> 1. Identify and understand the principles of chemical equilibrium thermodynamics to solve multiphase equilibria and chemical reaction equilibria. 2. Analyze the conditions associated with ideal and non-ideal vapour-liquid systems at equilibrium through the construction and interpretation of phase diagrams for ideal and non-ideal binary mixtures. 	
UNIT-III Electrochemistry	<ol style="list-style-type: none"> 1. acquire basic knowledge of electrode potentials & electrochemical cells; 2. differentiate between electrolytic and electrochemical cells; 3. determine the solubility of sparingly soluble salts; 4. explain the various methods for the determination of transference number; 5. Acquire basic principles underlying electro-analytical techniques. 	
UNIT-IV: Chemical Kinetics	<ol style="list-style-type: none"> 1. To understand the types and kinetics of fast reactions 2. To know the kinetics of flow techniques. 	

B.Sc. -II , Semester - III
CH - 301:Paper- I
(Inorganic Chemistry)
Unit - I
(A) MO theory

1. Apply the VSEPR model to determine a molecule's electronic geometry and molecular geometry based on its Lewis dot structure.
2. Interpret line drawings of chemical compounds with implicit hydrogen, carbons, and lone pairs.
3. Apply the VB model to determine the orbital hybridization for any atom in a given molecule.

Unit- II:
A) Chemistry of elements of first transition series
B) Non-aqueous solvents.

1. Able to write electronic configuration of given atomic number.
2. Able to tell the name of orbital by recognizing shapes of orbitals.
3. Able to calculate bond order of different molecules.
4. Able to draw MO diagrams of different molecules.
5. Able to draw structures of different ionic solids.
6. Able to calculate effective nuclear charge using Slaters Rule.

Unit- III:
a) Chemistry of elements of second and third transition series:
b) Errors in Chemical Analysis

1. The students will be able to design and carry out scientific experiments as well as accurately record and analyze the results of experiments.
2. Students will be able to explain why chemistry is an integral activity for addressing social, economic and environmental problems.

Unit - IV:
Chemistry of Lanthanides
A) Chemistry of Actinides:

1. Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
2. The students will be able to describe the periodic table as a list of elements arranged so as to demonstrate trends in their physical and chemical properties.
3. The students will be able to state the principle resemblances of elements within each main group in particular alkali metals, alkaline earth metals, halogens and noble gases.

CH-302 :
Paper- II (Organic

1. Recognize and draw constitutional isomers, stereoisomers, including enantiomers and diastereomers, racemic mixture and

Chemistry)

Unit –I

- a) Orientation :
- b) Poly halogen compounds

meso compounds.

2. Know the fundamental principles of organic chemistry and predict outcomes and derive mechanism of various types of organic reactions.

3. Understand various types of reactive intermediates and factors affecting their stability.

4. Understand the nomenclature, synthesis, isomerism and physical properties of alkanes and cycloalkanes

- Define, classify and name the alcohols, phenols and ethers.
- Discuss the structure and physical properties of alcohols, phenols and ethers.
- Describe the significance, preparation methods, physical, chemical properties and uses of important alcohols, methanol and ethanol.
- Explain the acidic behavior of phenol.
- Give effect of substituent's on acidity of phenol.
- Describe the importance, structure, physical properties, preparation methods, chemical reactions and uses of ethers.
- Compare the properties of alcohols and phenols.
- Compare the properties of isomeric alcohols and ethers.

Unit – II

- A) Alcohols
- B) Phenol

Unit – III

Aldehydes and ketones

1. Define, classify and name the Aldehydes and ketones.
2. Discuss the structure and physical properties of Aldehydes and ketones.
3. Describe the significance, preparation methods, physical, chemical properties and uses of important Aldehydes and ketones.

Unit IV

- A) Carboxylic Acids
- B) Carboxylic acid derivatives

1. Define, classify and name the Carboxylic Acids and Carboxylic acid derivatives
2. Discuss the structure and physical properties of Carboxylic Acids And Carboxylic acid derivatives
3. Describe the significance, preparation methods, physical, chemical properties and uses of important of Carboxylic Acids

and Carboxylic acid derivatives

B.Sc. -II ,
Semester – IV
CH – 401:
Paper- I (Inorganic
Chemistry)
Unit-I Coordination
compounds

Unit- II:

- A) Isomerism in coordination compounds
B) Oxidation and reduction

Unit- III:

- A) Organometallic Chemistry
B) Metal carbonyls-

Unit -IV :

- a) Bioinorganic Chemistry
b) Hard and Soft Acids and Bases

1. Determine the oxidation state of each atom in a compound.
2. Balance Redox reactions in acidic and basic solutions.

1. the prediction of mechanisms for organic reactions
2. how to use their understanding of organic mechanisms to predict the outcome of reactions
3. how to design syntheses of organic molecules

1. have firm foundations in the fundamentals and application of current chemical and scientific theories.
2. Are able to design, carry out, record and analyze the results of chemical experiments.
- 3.

1. Write chemical reactions for acids and bases.
2. Describe the preparation of a buffer.
3. Describe the use of acid-base indicators.
4. Discuss the common ion effect as it relates to acids and bases in solution.

<p>CH- 402: Paper- II (Physical Chemistry) UNIT- I Thermodynamics</p>	<ol style="list-style-type: none"> 1. Understand the concepts of thermodynamics and energy resources. 2. Classify the types of materials and their applications. 	
<p>UNIT -II Electrochemistry</p>	<ol style="list-style-type: none"> 1. acquire basic knowledge of electrode potentials & electrochemical cells; 2. differentiate between electrolytic and electrochemical cells; 3. determine the solubility of sparingly soluble salts; 4. explain the various methods for the determination of transference number; 5. Acquire basic principles underlying electro-analytical techniques. 	
<p>Unit-III A) Nuclear chemistry B) Dipole moment</p>	<ol style="list-style-type: none"> 1. Describe the structure of the nucleus. 2. Define alpha and beta particles and gamma radiation. 3. Use isotopic notation to write a nuclear reaction. 	
<p>Unit IV : Spectroscopy Rotational Spectroscopy B) Vibrational Spectra :</p>	<ol style="list-style-type: none"> 4. Discuss the kinetics of radioactive decay and the meaning of half-life. 5. Discuss the detection of radiation. 6. Discuss radioactive dating. 7. Give examples of medical applications of nuclear chemistry. 8. Differentiate between nuclear fusion and nuclear fission. 	
<p>CH- 501: Paper- I (Organic Chemistry) UNIT- I Organic compounds of Nitrogen & Amines</p>	<ol style="list-style-type: none"> 1. Students are able to identify and solve chemical problems and explore new areas of research. 2. Students are skilled in probing solving, critical thinking and analytical reasoning. 3. After completion of course students should have the ability to identify organic compounds by analysis and interpretation of 	

UNIT-II
HETEROCYCLIC
COMPOUNDS :

spectral data.

1. Recognize and draw constitutional isomers, stereoisomers, including enantiomers and diastereomers, racemic mixture and meso compounds.
2. Know the fundamental principles of organic chemistry and predict outcomes and derive mechanism of various types of organic reactions.
3. Understand various types of reactive intermediates and factors affecting their stability.
4. Understand the nomenclature, synthesis, isomerism and physical properties of alkanes and cycloalkanes

UNIT-III
Quantitative
Analysis :
Organometallic
compounds :

1. The students should be able to demonstrate advanced knowledge and understanding in aspect of protein structure.
2. The students will be able to introduce about basic chemistry of the heterocyclic.
3. The students will get familiar with particular properties and reactions for the most important heterocyclic as well as different systems of nomenclature.
4. The students will develop fundamental theoretical understanding of heterocyclic chemistry.
5. The students will be able to fully comprehend the chemistry of many heterocyclic products, carbohydrate, amino acids, peptides, proteins and lipids in use such as drugs and food.

UNIT-IV
SPECTROSCOPY :
Electromagnetic spectrum
Infrared (IR) absorption
spectroscopy

1. Students are able to recognize mechanism of different reactions related to carbonyl compounds.
2. Students are able to differentiate between given different amines.
3. Able to recognize different functional groups by given only graph of peaks.
4. Able to write mechanism of different condensation reaction.
5. Able to recognize the reactivity of substituted aromatic amines.

CH- 502:Paper- II
(Physical Chemistry)

Unit I : Quantum
Chemistry I

1. Students are able to identify and solve chemical problems and explore new areas of research.
2. Students are skilled in probing solving, critical thinking and analytical reasoning.
3. After completion of course students should have the ability to identify organic compounds by analysis and interpretation of spectral data.

Unit II :

- A) Quantum Chemistry
B) Molecular orbital
theory

1. Identify, select and explain which concepts are involved and in which way in the theoretical framework of quantum mechanics.
2. Identify, describe and explain the quantum mechanical behavior of simple systems, such as the harmonic oscillator and the rigid rotor.
3. Describe the basic properties of spin and identify the theoretical framework used to describe spin quantum mechanics.

Unit III

- A) Solutions and
Colligative
properties
B) Magnetic properties
:

1. Describe the theoretical basis behind the variational method and linear variation functions, and apply these methods to simple atomic and molecular systems, such as the hydrogen atom and the hydrogen molecule ion.
2. Construct many-electron wave functions as Slater-determinants from single-electron wave functions within the orbital-approximation, and understand how the properties of these approximate wave functions compare to more exact wave functions

Unit IV

- A) Photochemistry
B) Raman Spectroscopy

1. The main colligative properties of solution include freezing point depression, boiling point elevation and osmotic pressure.

<p>B.Sc. –III, Semester – VI CH – 601: Paper- I (Inorganic Chemistry)</p> <p>Unit- I</p> <p>A) Metal ligand bonding in Transition Metal Complexes</p> <p>B) Electronic spectra of Transition Metal Complexes</p> <p>Unit-II</p> <p>A) Magnetic Properties of Transition Metal Complexes:</p> <p>B) Thermodynamic and Kinetic aspect of metal complexes:</p> <p>Unit –III</p> <p>A) Colorimetry and Spectrophotometer</p>	<p>2.After learning freezing point depression, student will be able to calculate freezing point of a solution the unknown molar mass of a solute in the solution</p> <p>3.Under Boiling point elevation, student will be able to learn how to calculate the boiling point of solution the unknown molar mass of solute in the solution.</p> <p>1. Students are able to identify and solve chemical problems and explore new areas of research.</p> <p>2. Students are skilled in probing solving, critical thinking and analytical reasoning.</p> <p>3. After completion of course students should have the ability to identify organic compounds by analysis and interpretation of spectral data.</p> <p>1. The students will be able to design and carry out scientific experiments as well as accurately record and analyse the results of experiments.</p> <p>2. Students will be able to explain why chemistry is an integral activity for addressing social, economic and environmental problems.</p> <p>3. Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.</p> <p>4. The students will be able to describe the periodic table as a list of elements arranged so as to demonstrate trends in their physical and chemical properties.</p> <p>1. The students will develop the ability of effective solving practical problem of analytical chemistry of non-aqueous solutions.</p>	
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<p>B) Separation Techniques CH- 602: Paper- II (Organic Chemistry)</p>	<p>2. Students will be able to describe different quantitative methods of analysis of organic and inorganic substances. 3. Students will be able to demonstrate methods of drugs analysis and pharmaceutical calculations.</p>	
<p>Unit- IV Inorganic Polymers:</p>	<p>Students will demonstrate an advanced level of knowledge in bioinorganic chemistry.</p>	
<p>UNIT- I : NMR</p>	<p>1. Students are able to identify and solve chemical problems and explore new areas of research. 2. Students are skilled in probing solving, critical thinking and analytical reasoning. 3. After completion of course students should have the ability to identify organic compounds by analysis and interpretation of spectral data.</p>	
<p>UNIT- II ORGANIC SYNTHESIS VIA ENOLATES CARBOHYDRATES</p>	<p>1. After study of course students have firm foundations in the fundamentals and application of current chemical and scientific theories. 2. Students are able to identify and solve chemical problems and explore new areas of research. 3. Students are skilled in probing solving, critical thinking and analytical reasoning. 4. After completion of course students should have the ability to identify organic compounds by analysis and interpretation of spectral data. 5. Students should have the ability to explain common terms in NMR spectroscopy such as chemical shift, coupling constant and anisotropy and describe how they are affected by molecular structure. 6. Students are skilled to perform the most commonly used NMR experiments and to interpret and document their results.</p>	
<p>UNIT-III A) AMINO ACIDS, PEPTIDES,</p>	<p>1. The students should be able to demonstrate advanced knowledge and understanding in aspect of protein structure.</p>	

<p>PROTEINS & NUCLEIC ACIDS B) FATS, OILS AND DETERGENTS</p>	<ol style="list-style-type: none"> 2. The students will be able to introduce about basic chemistry of the heterocyclic. 3. The students will get familiar with particular properties and reactions for the most important heterocyclic as well as different systems of nomenclature. 4. The students will develop fundamental theoretical understanding of heterocyclic chemistry. 5. The students will be able to fully comprehend the chemistry of many heterocyclic products, carbohydrate, amino acids, peptides, proteins and lipids in use such as drugs and food. 	
<p>UNIT- IV A) SYNTHETIC DYES B) SYNTHETIC DRUGS C) SYNTHETIC POLYMERS</p>	<ol style="list-style-type: none"> 1. isolate the key design features of a product which relate directly to the material(s) used in its construction 2. indicate how the properties of polymeric materials can be exploited by a product designer 3. describe the role of rubber-toughening in improving the mechanical properties of polymers 4. identify the repeat units of particular polymers and specify the isomeric structures which can exist for those repeat units 5. Estimate the number- and weight-average molecular masses of polymer samples given the degree of polymerization and mass fraction of chains present. 	