

# GDC Memorial College

Bahal (Bhiwani)-127028

NAAC Accredited Grade "B" (Second Cycle) and Recognized under

The Section 2(f) & 12 (B) of the UGC Act, 1956

Affiliated to Ch. Bansi Lal University, Bhiwani

## Department of Chemistry

### M.Sc Chemistry

Program Learning Outcomes, Program Outcomes and Course Learning Outcomes

#### PROGRAMME LEARNING OUTCOMES

The graduate on completion of Master in Chemistry programme will be able to:

<b>PLO 1</b>	<b>Development of Understanding about BASICS</b>	<b>Demonstrate advanced knowledge about chemistry with a critical understanding of the emerging developments and issues relating to the learners domain area.</b>
<b>PLO 2</b>	<b>Critical thinking and analysis</b>	Demonstrate advanced knowledge and understanding of principles, methods, and techniques applicable to the chosen field of study.
<b>PLO 3</b>	<b>Applications of Knowledge and Skills Acquired</b>	Demonstrate the capacity to extrapolate the acquired knowledge and skills to real-life situations and apply acquired competencies in new/unfamiliar contexts.
<b>PLO 4</b>	<b>Ability to Identity Real World Problems</b>	Demonstrate the ability to apply the acquired conceptual, operational or technical knowledge and a range of cognitive and practical skills to identify and address problems related to the chosen field of learning.
<b>PLO 5</b>	<b>Developing Research Aptitude</b>	Demonstrate and apply the advanced knowledge relating to research methods to carryout research and investigations to formulate evidence-based solutions to complex and unpredictable problems in the field of Chemistry.
<b>PLO 6</b>	<b>Data Analysis and Its Interpretation</b>	Demonstrate the ability to communicate, in a well-structured manner the findings/ results of the research studies undertaken in the field of Chemistry.
<b>PLO 7</b>	<b>Values and Ethics</b>	Pursue self-paced and self- directed learning to upgrade knowledge and skills, including research-related skills avoiding unethical practices.

## **Program Outcomes (PO)**

After successful completion of two year degree program in chemistry students should be able to;

**PO1:** Understand the three laws of thermodynamics.

**PO2:** Learn the phase equilibrium and phase diagrams.

**PO3:** Learn the enzymatic reaction and their mechanism.

**PO4:** Able to understand basic terms in computer science

**PO5:** Able to solve statistical problems like mean, median and mode

**PO6:** Learn different type of rearrangement reaction and mechanism

### **M.Sc. (Chemistry) 1<sup>st</sup> Sem.**

**Subject: Inorganic Chemistry**

**Subject Code: 25PN-CHE-101**

#### **Course Outcomes (CO)**

After successful completion of the course, the student is expected to:

**CLO 1:** Understand the concept of metal-ligand bonding in transition metal complexes by exploring theories such as Crystal Field Theory (CFT), Ligand Field Theory (LFT), and Molecular Orbital (MO) theory.

**CLO 2:** Explain the mechanisms of ligand substitution in octahedral transition metal complexes, and analyze the thermodynamic aspects of coordination complexes.

**CLO 3:** Understand the reaction mechanisms of ligand substitution in square planar transition metal complexes, and gain knowledge of the redox chemistry involved in coordination complexes.

**CLO 4:** Describe the structures and properties of isopoly and heteropoly acids and their salts, and explain the crystal structures of selected binary and ternary compounds.

### **M.Sc. (Chemistry) 1<sup>st</sup> Sem.**

**Subject: Physical Chemistry**

**Subject Code: 25PN-CHE-102**

#### **Course Outcomes (CO)**

After successful completion of the course, the student is expected to:

**CLO 1:** Basic Postulates of quantum Mechanics & Concept of Operators, Particle in a box problem

**CLO 2:** Laws of thermodynamics & phase equilibrium, Concept of Entropy and its calculation for various processes

**CLO 3:** Rate law of different order reactions (zero, first & second order) and consecutive, parallel, opposed & chain reactions

**CLO 4:** Explain Debye Huckle Theory of ion-ion interactions for the determination of activity and activity coefficients of electrolytic solution.

**M.Sc. (Chemistry) 1<sup>st</sup> Sem.**

**Subject: Organic Chemistry**

**Subject Code: 25PN-CHE-103**

**Course Outcomes (CO)**

After successful completion of the course, the student is expected to:

**CLO1:** Understand the concepts delocalisation, conjugation and aromaticity and organic reaction mechanism

**CLO2:** Advanced knowledge of reaction intermediates, aliphatic nucleophilic and electrophilic substitution

**CLO3:** Basic knowledge of concepts of Stereochemistry, conformational analysis of acyclic and cyclic molecule. Optical activity in absence of chiral carbon, topicity of ligands and faces and their nomenclature

**CLO4:** In-depth understanding of asymmetric synthesis

**M.Sc. (Chemistry) 1<sup>st</sup> Sem.**

**Subject: Chemistry in everyday life**

**Subject Code: 25PN-CHE-106**

**Course Outcomes (CO)**

After successful completion of the course, the student is expected to:

**CLO 1:** Explain the fundamental chemical principles governing the properties and applications of common everyday products and materials.

**CLO 2:** Analyze the chemical composition and impact of food, pharmaceuticals, and personal care items on human health.

**CLO 3:** Evaluate the role of chemistry in understanding and addressing environmental challenges and promoting sustainable practices.

**CLO 4:** Discuss the societal implications of chemical advancements and critically assess chemically-related information in various contexts.

**M.Sc. (Chemistry) 2nd Sem.**

**Subject: Inorganic Chemistry-II**

**Subject Code: 25PN-CHE-201**

**Course Outcomes (CO)**

After successful completion of the course, the student is expected to:

**CLO1:** Learn about different concepts of Reaction Mechanism of Transition Metal Complexes-II

**CLO2:** Learn the fundamentals and applications of Magnetic Properties of transition metal complexes

**CLO3:** Learn about the Electronic Spectra and Magnetic Properties of Transition Metal Complexes

**CLO4:** Understand the Metal  $\pi$ - Complexes

**CLO5:** Understand the concepts of Metal Clusters

**M.Sc. (Chemistry) 2nd Sem.**

**Subject: Physical Chemistry-II**

**Subject Code: 25PN-CHE-202**

**Course Outcomes (CO)**

After successful completion of the course, the student is expected to:

**CLO1:** Learn about different concepts of Third law of thermodynamics, Nernst heat theorem, concept of absolute entropy

**CLO2:** Learn the fundamentals and applications of Chemical Dynamics

**CLO3:** Learn about the Statistical Mechanics

**CLO4:** Understand the Laws of photochemistry

**CLO5:** Understand the concepts of Stern Volmer equation

**M.Sc. (Chemistry) 2nd Sem.**

**Subject: Organic Chemistry-II**

**Subject Code: 25PN-CHE-203**

**Course Outcomes (CO)**

After successful completion of the course, the student is expected to:

**Course Outcomes (CO)**

After successful completion of the course, the student is expected to:

**CLO1:** Learn about different concepts of Aromatic Electrophilic Substitution

**CLO2:** Learn the fundamentals and applications of Elimination Reactions

**CLO3:** Learn about the Addition to Carbon-Carbon Multiple Bonds

**CLO4:** Understand the Addition to Carbon-Hetero Multiple Bonds

**CLO5:** Classification and general mechanistic treatment of nucleophilic

**M.Sc. (Chemistry) 2nd Sem.**

**Subject: Spectroscopy**

**Subject Code: 25PN-CHE-204**

**Course Outcomes (CO)**

After successful completion of the course, the student is expected to:

**CLO1:** Learn about Introduction and understanding of UV-Visible phenomenon

**CLO2:** Learn the fundamentals and applications of Infrared Spectroscopy

**CLO3:** Learn about the Nuclear Magnetic Resonance Spectroscopy

**CLO4:** Understand the Mass Spectrometry

**CLO5:** Understand the concepts of Carbon-13 NMR Spectroscopy and Heteronuclear Coupling

**M.Sc. (Chemistry) 3<sup>rd</sup> Sem.**

**Subject: Spectroscopy-II**

**Subject Code: 22CHE-301**

**Course Outcomes (CO)**

After successful completion of the course, the student is expected to:

**CLO1:** Learn about rotational and vibrational spectra for different molecules.

**CLO2:** Learn about the Vibrational-Rotational spectra and the concept of harmonicity.

**CLO3:** Learn about the raman and electronic spectra of different molecules.

**CLO4:** Understand the electron spin resonance spectroscopy and Mossbauer spectroscopy.

**CLO5:** Understand the concept of Atomic absorption spectroscopy , flame photometry and Colorimetry.

**M.Sc. (Chemistry) 3<sup>rd</sup> Sem.**

**Subject: Organotransition Metal Chemistry**

**SubjectCode: 22CHE-302**

**Course Outcomes (CO)**

After successful completion of the course, the student is expected to:

**CLO1:** Understand and Classify the Organometallic Compounds

**CLO2:** Learn about the Alkyls and aryls of Transition Metals.

**CLO3:** Learn about the transition metal pi Complexes.

**CLO4:** Learn about the Compounds of Transition Metal-Carbon Multiple Bonds .

**CLO5:** Learn about the Homogenous Catalysis.

**M.Sc. (Chemistry) 3<sup>rd</sup> Sem.**

**Subject: Instrumental Techniques-I**

**SubjectCode: 22CHE-305**

**Course Learning Outcomes (CLO)**

After successful completion of the course, the student is expected to:

**CLO1:** Learn about the different method of analysis like Electroanalytical Methods.

**CLO2:** Learn about the different types of titration and titration curve.

**CLO3:** Learn about the polarography, voltammeter.

**CLO4:** Understand the principles of Chromatography and its uses.

**CLO5:** Learn about the different Thermal Techniques

**M.Sc. (Chemistry) 3<sup>rd</sup> Sem.**

**Subject: Modern Concepts of Inorganic Chemistry**

**Subject Code: 22CHE-308**

**Course Learning Outcomes (CLO)**

After successful completion of the course, the student is expected to:

**CLO1:** Learn about the different inorganic polymers and non aqueous solvents.

**CLO2:** Learn about the isopoly and heteropoly Acids and salts..

**CLO3:** Learn about the basics of photochemistry.

**CLO4:** Understand about the sewage treatment and fertilizers.

**CLO5:** Learn about the radioactivity and nuclear chemistry.

**M.Sc. (Chemistry) 4<sup>th</sup> Sem.**

**Subject: Inorganic Chemistry Special-IV  
(Bioinorganic and Medicinal Chemistry)**

**Subject Code: 22CHE-401**

**Course Learning Outcomes (CLO)**

After successful completion of the course, the student is expected to:

**CLO1:** Understand bioinorganic chemistry of Na<sup>+</sup>, K<sup>+</sup>, Mg<sup>2+</sup> and Ca<sup>2+</sup>.

**CLO2:** Able to understand Electron Transfer in Biological Systems.

**CLO3:** Able to know about Fixation of dinitrogen biologically and abiologically.

**CLO4:** Able to understand Biochemical basis of essential metal deficient diseases like Iron, copper and zinc deficiencies.

**CLO5:** Know about different classes of Inorganic drugs like Inorganic drugs in dental carries, Inorganic compounds as antacids.

**CLO6:** Learn about Anticancer activity and mechanism of platinum complexes.

**CLO7:** Able to understand Antibacterial and antiviral properties of metal complexes.

**M.Sc. (Chemistry) 4<sup>th</sup> Sem.**

**Subject: Inorganic Chemistry Special-V  
(Instrumental Techniques –II)**

**Subject Code: 22CHE-404**

**Course Learning Outcomes (CLO)**

After successful completion of the course, the student is expected to:

**CLO1:** Able to understand use of symmetry to determine the number of active infrared and Raman lines.

**CLO2:** Learn about Application of resonance Raman Spectroscopy particularly for the study of active sites of metalloproteins as myoglobin and haemoglobin.

**CLO3:** Learn structural elucidation of inorganic compounds using NQR spectroscopy.

**CLO4:** Able to understand Magnetic Resonance Imaging by applications of NMR ( $^{19}\text{F}$ ,  $^{31}\text{P}$ ).

### **M.Sc. (Chemistry) 4<sup>th</sup> Sem.**

**Subject: Inorganic Chemistry Special-VI**  
**(Advance Topics in Inorganic Chemistry)**

**Subject Code: 22CHE- 407**

#### **Course Learning Outcomes (CLO)**

After successful completion of the course, the student is expected to:

**CLO1:** Develop pharmaceutical therapies by understanding the interactions at a drug binding site.

**CLO2:** Know about Molecular receptors for different types of molecules.

**CLO3:** Able to design and synthesis of co-receptor molecules.

**CLO4:** Know about properties of nano structured materials (opticals, magnetic, chemical and photo catalytic properties).

**CLO5:** Able to know techniques for Nano materials synthesis (Hydrothermal, Solvotherm- al, solgel, Physical Vapour deposition (PVD) etc.

**CLO6:** Able to understand characterization of nonmaterial's by X-ray diffraction (XRD), Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) etc.

**CLO7:** Able to apply nanoscience and nanotechnology in various fields.

**CLO8:** Understand Defects and Non-stoichiometry in Solid State.

**CLO9:** Learn about Metals, insulators and semiconductors and their Optical and Magnetic

### **M.Sc. (Chemistry) 4<sup>th</sup> Sem.**

**Subject: Communication Skills**

**Subject Code: 22CHE-410**

#### **Course Learning Outcomes (CLO)**

After successful completion of the course, the student is expected to:

**CLO1:** To enable the students to communicate effectively and conduct themselves graciously in the business of life.

**CLO2:** Preparing for interviews, CV/ Biodata, Group Discussion.

**CLO3:** Enable art of Small Talk, Participating in Conversations.

**CLO4:** Recognizing and Managing Emotions and situations like Stress and Anger Management

**CLO5:** Understand Personality Development Skills like Personal Grooming, Assertiveness, and Improving Self-Esteem.

**CO6:** Learn about significance of Critical Thinking.

### **Program Outcomes (PO)**

After successful completion of two year degree program in chemistry students should be able to;

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**PO4:** Able to understand basic terms in computer science

**PO5:** Able to solve statistical problems like mean, median and mode

**PO6:** Learn different type of rearrangement reaction and mechanism

### **Program Specific Outcomes (PSO)**

After completion of these courses students will able to:

**PSO1:** Able to understand different type of theories which help them in competitive exam.

**PSO2:** Basic reaction mechanism will help students to carry out experiments in various research fields.

**PSO3:** Statistical analysis will help out in research are and data analysis.

**PSO4:** Students will also learn basic concepts of computer and IT skills.

**PSO5:** Inorganic specialization will help students to select their future option.

**PSO6:** Students will be capable of presentation on the topic assigned; use of board or power point presentation.