CURRICULUM & SYLLABUS



Bachelor of Science (Hons.) Chemistry

or

Bachelor of Science (Hons.) Chemistry with Research/

Academic Projects

(A 4 Year Undergraduate Degree Program)

Under UGC Framework - 2022 based on NEP – 2020

(w.e.f. Academic Year 2023-24)

DEPARTMENT OF CHEMISTRY

FACULTY OF SCIENCE AND HUMANITIES

SRM UNIVERSITY DELHI-NCR, SONEPAT

Plot No.39, Rajiv Gandhi Education City

## Sonepat Haryana-131029

## Vision

The Department of Chemistry is committed to providing intellectual, innovative, and motivational surroundings to students and faculty members. The department is focused on contributing academic, scientific, research, and experimental knowledge through excellence and producing scientists, researchers, and bureaucrats. The department wants to strive and achieve the reputation of seeking the attention of the government of India and the use of others to be invited to provide services on subjects involving chemistry and allied areas.

## Mission

* To improve the problem-solving capability of students through continuous learning to produce quality Chemists, Scientists, Academic intellectuals etc. in the field of Science and Technology.
* To bridge the gap between industry and academia by imparting technical/experimental knowledge along with its application in the practical world.
* To encourage innovation through multidisciplinary research and development activities.
* To inculcate human values and ethics into students to serve the society and nation with utmost devotion.
* To develop the overall personality of students along with the learning process simultaneously.

# SCIENCE GRADUATE EMPLOYABILITY ATTRIBUTES

* + Sound Knowledge and Understanding of the Domain Area
  + Analytical and Critical Thinking and Problem-Solving Skills
  + Scientific Temperament Towards Research and Innovation for the Betterment of Society
  + Efficient Communication and Presentation Skills
  + Dependability, Reliability, Responsibility, and Independent Leadership Abilities

# PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

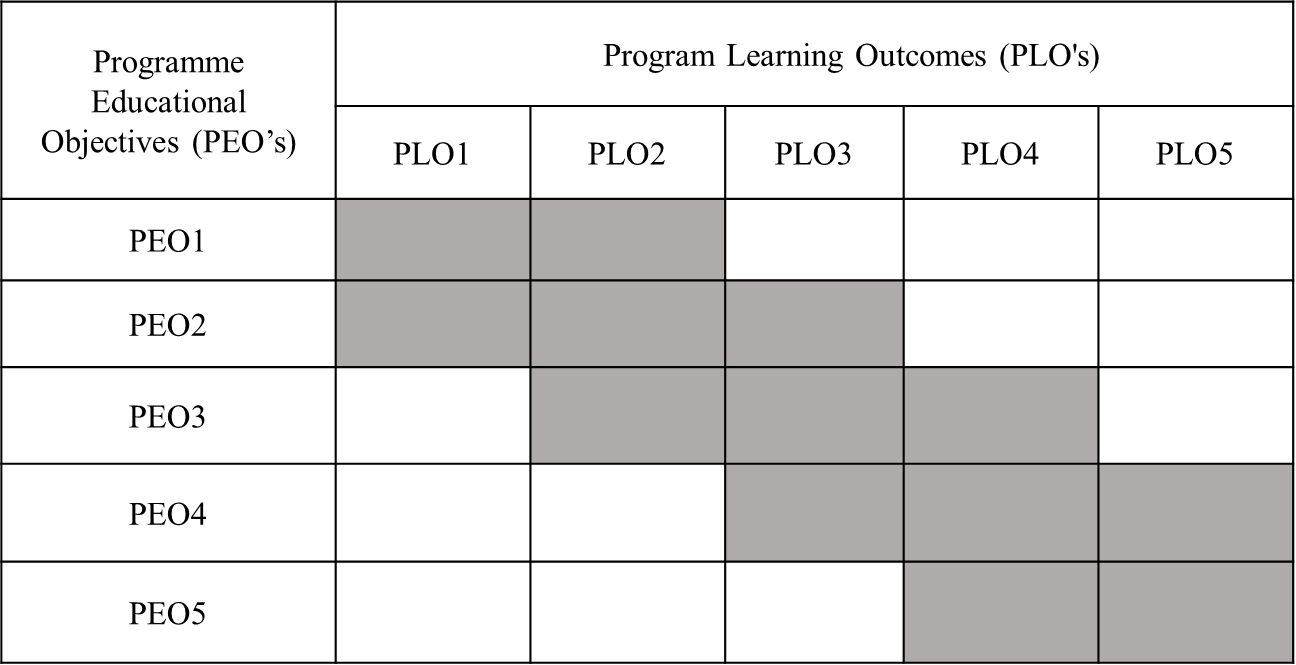
* To impart knowledge and understanding of the concepts of Organic Chemistry, Inorganic Chemistry, Physical Chemistry and related allied subjects.
* To equip students to handle apparatus and basic instrumentation used in chemistry laboratory to synthesize, isolate, and characterize molecules and materials.
* To interpret, analyze, and connect the multiple concepts of various topics through numerical, assignment, quiz, and experiment or project.
* To organize seminars, workshops, and group discussions on related topics and societal problems.
* To develop and enhance the writing, reviewing, and presentation skills of students.

# PROGRAM LEARNING OUTCOMES (PLOs)

## The students would be able to have:

* Knowledge and understanding of the fundamental concepts of Physical Chemistry, Organic Chemistry, Inorganic Chemistry, and allied subjects, along with their applications in research and industry.
* Better learning through a theoretical and evidence-based approach to explaining the chemical synthesis, analysis, and characterization of materials.
* Ability to demonstrate the basic principles of equipment and instruments.
* Ability to work both independently and in groups on complex problems to apply scientific knowledge to develop entrepreneurial abilities.
* Capacity to identify the research problem(s), plan, design, execute, and present the results and findings in a scientific manner.

# MAPPING OF PROGRAM EDUCATIONAL OBJECTIVES AND PROGRAM LEARNING OUTCOMES

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**Semester-I**

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| **Inorganic Chemistry-I (Atomic Structure & Chemical Bonding)** | |
| **Course Code: 23CYBS101** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES

* To impart the students’ knowledge about atomic structure, wave functions & all the related theories.
* To develop student’s understanding about periodic table and some properties of the periodic table.
* To illustrate the various chemical bonds present in molecules.
* To make students acquainted with the various concepts of chemical bonds and their properties.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Solve the conceptual questions about all the models of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbital,
* Explain periodicity in atomic radii, ionic radii, ionization energy and electron affinity of elements.
* Replicate the plausible structures and geometries of molecules using VSEPR theory and MO diagrams (homo- & hetero-nuclear diatomic molecules).
* Describe the importance and applications of chemical bonding and their effect on physical & chemical properties.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
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| **PHYSICAL CHEMISTRY-I (Gaseous State and Kinetics)** | |
| **Course Code: 23CYBS102** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES

* To understand states of gases, behavior of real gases and ideal gases.
* To describe the behavior of real gases.
* To illustrate the theory of reaction rates.
* To explain the mechanism of enzyme catalysis and its effect on the reaction.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Derive mathematical expressions for different properties of gas and understand their physical significance.
* Demonstrate the behavior of real gases.
* Determine the rate law and rate of reaction.
* Explain the mechanism of enzyme catalysis.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
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| **PRACTICAL INORGANIC CHEMISTRY-I** | |
| **Course Code: 23CYBS151** | Continuous Evaluation: 60 Marks |
| **Credits: 2** | End Semester Practical Examination: 40 Marks |
| **L T P : 0 0 4** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES (CO)

* To be familiar with the calibration and use of apparatus, preparation of standard solutions.
* To illustrate the volumetric titrations.
* To understand the concept of redox titrimetry.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Illustrate the calibration, use of laboratory apparatus & preparation of standard solutions of different concentrations.
* Explain concept of basicity & acidity on the basis of volumetric analysis.
* Demonstrate external & internal indicators in redox titrimetry.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | |
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| **PHYSICAL CHEMISTRY PRACTICAL-I** | |
| **Course Code: 23CYBS152** | Continuous Evaluation: 60 Marks |
| **Credits: 2** | End Semester Practical Examination: 40 Marks |
| **L T P : 0 0 4** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES (CO)

* + To study the kinetics of the reactions by different methods of measurement.
  + To explain the first order kinetics through model reactions.
  + To have an understanding of monitoring a reaction rate on real time basis.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Describe the reaction kinetics by different methods.
  + Apply the concepts of chemical kinetics for studying the kinetics of various reactions.
  + Set up model kinetic reaction and monitor them.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | |
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# Semester II

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| **ORGANIC CHEMISTRY-I (Basic Concepts in Organic Chemistry)** | |
| **Course Code: 23CYBS201** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES

* To discuss the basics of organic chemistry and different types of organic reactions.
* To illustrate the conformation of alkane and cycloalkane and stereochemistry, geometries and absolute and relative configuration of chiral compounds.
* To develop students' understanding about the general methods for the synthesis of alkanes, alkenes, alkynes and their properties and chemical reactions.
* To understand the chromatographic techniques for separating organic compounds.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Apply the fundamental concepts of different nature and behavior of organic compounds.
* Elucidate the conformational, configurational and geometrical isomerism of organic molecules.
* Identify the various organic reaction mechanisms with examples
* Separate different organic compounds using chromatographic techniques.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
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| **ORGANIC CHEMISTRY PRACTICAL-I** | |
| **Course Code: 23CYBS251** | Continuous Evaluation: 60 Marks |
| **Credits: 2** | End Semester Practical Examination: 40 Marks |
| **L T P : 0 0 4** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES (CO)

* + - To understand the purification process of organic compounds by crystallization method.
    - To determine the boiling and melting point of organic compounds.
    - To develop students' understanding about the basic concept of chromatography for the separations of organic compounds
    - To illustrate the detection of extra elements of the given sample.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + - Determine boiling and melting point of organic compounds.
    - Analyze the effect of impurity in organic compounds and their purification by crystallization method.
    - Apply the concepts of separation techniques such as chromatography to separate mixtures.
    - Elucidate detecting various extra elements present in an organic compound.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
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| **PHYSICAL CHEMISTRY-II (Solid & Liquid State and Equilibria)** | |
| **Course Code: 23CYBS202** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES

* + To discuss the properties of liquid and solid states of matter.
  + To develop students' understanding about the X-Ray crystallography.
  + To highlight chemical equilibria in liquids and ideal gases.
  + To understand the concept of ionic equilibrium of various electrolytes.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Describe the chemistry of Micelles and cleansing agents.
  + Explain the crystal structure and calculate related properties of cubic systems.
  + Demonstrate the effects of parameters like pressure, temperature and catalyst on chemical reactions.
  + Replicate the preparation of buffer solutions to store enzymes or to carry out biological reactions.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
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| **PHYSICAL CHEMISTRY PRACTICAL-II** | |
| **Course Code: 23CYBS252** | Continuous Evaluation: 60 Marks |
| **Credits: 2** | End Semester Practical Examination: 40 Marks |
| **L T P : 0 0 4** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES (CO)

* To illustrate the determination of surface tension by different methods.
* To demonstrate the viscosity measurement by Ostwald method.
* To describe the powder diffraction pattern of crystals.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Explain the concept of surface tension and its measurement by different methods.
* Determine the coefficient of viscosity at different concentrations.
* Identify the types of crystal structures.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | |
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# Semester-III

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| **INORGANIC CHEMISTRY II (Chemistry of s & p block elements)** | |
| **Course Code: 23CYBS301** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES

* + To explain the principles of metallurgy & various processes of metal extraction from their ores.
  + To illustrate the properties of s-block elements and to study the properties of some of their compounds.
  + To make student comprehend the properties of p-block elements and the properties of some of their compounds.
  + To describe students the methods for the preparation, structure and properties of some inorganic compounds.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Describe the fundamental principles of metallurgy and the importance of recovery of byproducts during extraction.
  + Illustrate the periodicity in atomic and ionic radii, electronegativity, ionization energy, electron affinity of elements of the s-block elements.
  + Explain the periodicity in atomic and ionic radii, electronegativity, ionization energy, electron affinity of elements of the p-block elements.
  + Demonstrate the preparation, structure and properties of some inorganic compounds.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
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| **ORGANIC CHEMISTRY II (Haloalkanes, Haloarenes and Oxygen Containing Functional Groups)** | |
| **Course Code: 23CYBS302** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES

* + To discuss the reaction mechanism of organic halides and effect of various parameters on the rate of reaction.
  + To illustrate the chemistry of oxygen containing molecules like alcohols, phenols, ethers and

epoxides.

* + To highlight the chemistry of carbonyl compounds and carbonyl compounds based various name reactions.
  + To make students familiar with the chemical reactions of carboxylic acids and it’s derivatives such as ester, amide, acyl chloride, anhydride etc.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Describe the preparation, properties and reactions of haloalkanes, haloarenes.
  + Explain the chemical reactions of alcohols, phenols, ethers and epoxides. Will be able to carry out the functional group transformations.
  + Correlate the concept of chemistry of carbonyl compounds and their application in organic transformations.
  + Illustrate various reactions of carboxylic acids and its derivatives.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
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| **Introduction to Nanochemistry & Applications** | |
| **Course Code: 23CYBS303** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 2 0 2** | **Course Type: Core Course (Minor)** |

### COURSE OBJECTIVES

* + To illustrate the concept of size dependent properties of nano-materials/particles.
  + To impart the knowledge about the syntheses of nanomaterials.
  + To be familiar with the basic principles of techniques for characterization of nanomaterials.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Describe the size dependent properties of nano-materials/particles.
  + Demonstrate different methods for synthesis of nanomaterials.
  + Illustrate basic principles of techniques used for characterization of nanomaterials.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | |
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| **INORGANIC CHEMISTRY PRACTICAL-II** | |
| **Course Code: 23CYBS351** | Continuous Evaluation: 60 Marks |
| **Credits: 2** | End Semester Practical Examination: 40 Marks |
| **L T P : 0 0 4** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES (CO)

* + To discuss the redox titration by using iodine.
  + To highlight the concept of complexometric titration & calculate the hardness of water sample.
  + To make students familiar with the synthesis of various inorganic compounds.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Apply the concept of redox titration by using iodine.
  + Perform the complexometric titration.
  + Demonstrate the preparations of different inorganic compounds.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | |
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| **ORGANIC CHEMISTRY PRACTICAL-II** | |
| **Course Code: 23CYBS352** | Continuous Evaluation: 60 Marks |
| **Credits: 2** | End Semester Practical Examination: 40 Marks |
| **L T P : 0 0 4** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES (CO)

* To discuss the qualitative analysis of unknown organic compound.
* To highlight the synthesis of organic compounds by conventional method as well by greener approach.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Perform qualitative analysis of unknown organic compounds.
* Prepare different organic compounds by conventional method as well as green approach.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | |
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# Semester-IV

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| **Inorganic Chemistry-III (Chemistry of d & f Block Elements and Coordination Chemistry)** | |
| **Course Code: 23CYBS401** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES

* + To discuss the various theories & chemistry of coordination compounds.
  + To illustrate the chemistry of transition metal elements & their important compounds.
  + To explain the inorganic reaction mechanism and various factors, which can influence the rate of reaction in, square planar complexes.
  + To describe the chemistry of lanthanides and actinides.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Describe the basic concept of coordination compounds.
  + Explain the properties of transition elements.
  + Demonstrate the reaction mechanism of coordination compounds.
  + Analyze the various properties of lanthanides and actinides.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
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| **PHYSICAL CHEMISTRY-III (Phase Transition and Chemical Thermodynamics)** | |
| **Course Code: 23CYBS402** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES

* + To discuss the terms of the phase equilibria and draw the phase diagram of different component system.
  + To illustrate the change in the colligative properties of the system.
  + To highlight the various laws of thermodynamics.
  + To understand the reversible and irreversible processes based on the different free energy functions and concept of entropy.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Identify the state of various component system using phase diagrams.
  + Illustrate the effect of solute on the physical properties of solution.
  + Implement the laws of thermodynamics to explain the behavior of a system.
  + Demonstrate the second and third law of thermodynamics and related applications.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
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| **ANALYTICAL METHODS IN CHEMISTRY** | |
| **Course Code: 23CYBS403** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Minor)** |

### COURSE OBJECTIVES:

* To understand the fundamentals of analytical chemistry, analytical tools, statistical methods applied to analytical chemistry.
* To explain the principles of XRD & electron microscopy and their applications.
* To apply the basic principles of spectroscopic, thermal, electrochemical techniques
* To implement the basics and advanced separation technique.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Perform experiment with accuracy and precision and develop methods of analysis for different samples independently.
* Elucidate the basic principle and working of instrument like Flame Photometer, XRD & electron microscopy.
* Demonstrate separation of analytes by chromatography and test contaminated water samples.
* Determine the applications of separation techniques.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
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| **INORGANIC CHEMISTRY PRACTICAL- III** | |
| **Course Code: 23CYBS451** | Continuous Evaluation: 60 Marks |
| **Credits: 2** | End Semester Practical Examination: 40 Marks |
| **L T P : 0 0 4** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES (CO)

* To discuss the gravimetric analysis of different transition metals.
* To discuss the preparation of various coordination complexes.
* To impart the knowledge of transition metal complexes spectrophotometrically.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Determine the Execute gravimetric analysis of different transition metals.
* Demonstrate how to prepare coordination compounds.
* Explain the properties of transition metal complexes experimentally.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | |
| **CLO 1** | **CLO 2** | **CLO 3** |
| **CO 1** |  |  |  |
| **CO 2** |  |  |  |
| **CO 3** |  |  |  |

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| **PHYSICAL CHEMISTRY PRACTICAL-III** | |
| **Course Code: 23CYBS452** | Continuous Evaluation: 60 Marks |
| **Credits: 2** | End Semester Practical Examination: 40 Marks |
| **L T P : 0 0 4** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES (CO)

* + To discuss the determination of critical solution temperature and composition.
  + To impart the knowledge of the equilibrium of reactions by distribution method.
  + To conduct the pH metric titration.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Determine the critical solution temperature and composition.
  + Estimate the equilibrium of reactions by distribution method.
  + Demonstrate the pH metric titration of different acids and bases.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | |
| **CLO 1** | **CLO 2** |
| **CO 1** |  |  |
| **CO 2** |  |  |

**Semester-V**

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| **ORGANIC CHEMISTRY-III (Heterocyclic Chemistry, Nitrogen Containing Functional Groups and Polynuclear Hydrocarbons)** | |
| **Course Code: 23CYBS501** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES

* + To discuss the preparation and properties of nitrogen containing molecules.
  + To illustrate the polynuclear hydrocarbons, their structure elucidation and preparation with properties.
  + To explain the five and six-membered heterocyclic molecules, their methods of preparation and properties.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Describe the preparation and properties of nitrogen containing molecules.
  + Explain the polynuclear hydrocarbons, their structure elucidation and preparation with properties.
  + Demonstrate the various types of five and six-membered heterocyclic molecules, their methods of preparation and properties such as aromaticity, basicity, etc.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNINGOUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | |
| **CLO 1** | **CLO 2** | **CLO 3** | |
| **CO 1** |  |  |  | |
| **CO 2** |  |  |  | |
| **CO 3** |  |  |  | |

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| **Inorganic Chemistry-IV (Organometallics & Bioinorganic Chemistry)** | |
| **Course Code: 23CYBS502** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES

* To understand the structure, properties, preparation & bonding in organometallic compounds.
* To illustrate the formation of important complexes, their properties and bonding.
* To describe the concept of catalysis by organometallic compounds.
* To impart the knowledge about the concept of various categories of metal ions in biological systems.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Explain the structure, properties, preparation & bonding in organometallic compounds.
  + Identify important structural features of important complexes and explain the concept of multicentre bonding in these compounds.
  + Demonstrate the mechanism of Wilkinson’s catalyst, Zeigler- Natta catalyst and synthetic gasoline manufacture by Fischer-Tropsch process.
  + Explain the importance of various categories of metal ions in biological systems.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
| **CO 1** |  |  |  |  |
| **CO 2** |  |  |  |  |
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| **PHYSICAL CHEMISTRY IV (Electrochemistry, Surface Chemistry & Photochemistry)** | |
| **Course Code: 23CYBS503** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES

* To discuss the principles of conductance and electrolysis.
* To understand the concept and formulations of the electrochemical cells.
* To describe the theories of surface chemistry.
* To explain the laws of photochemistry.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Demonstrate the conductance behavior of different electrolytes in solution.
* Compare the reduction potential and cell potential of ionic solutions.
* Describe the theories of photochemistry.
* Elucidate the absorption of light and subsequent photochemical reactions

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
| **CO 1** |  |  |  |  |
| **CO 2** |  |  |  |  |
| **CO 3** |  |  |  |  |
| **CO 4** |  |  |  |  |

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| **Medicinal Chemistry** | |
| **Course Code: 23CYBS504** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Corse (Minor)** |

### COURSE OBJECTIVES

* To understand about biophysical properties of medicine/drugs.
* To make students familiar with structure, mode of action of therapeutic agents.
* To explain the basic concept of inflammation, steroids, vitamins, enzymes, contraceptive agents.
* To highlight the concept of drug design, SAR, QSAR.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Describe basics of medicinal chemistry, biophysical properties
* Analyze the biological activity, mode of action of therapeutic agents
* Illustrate drug metabolism, biophysical and chemical properties of enzymes, hormones, vitamins
* Explain the concept of rational drug design, SAR & QSAR

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
| **CO 1** |  |  |  |  |
| **CO 2** |  |  |  |  |
| **CO 3** |  |  |  |  |
| **CO 4** |  |  |  |  |

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| **Biomolecules of Life** | |
| **Course Code: 23CYBS505** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Minor)** |

### COURSE OBJECTIVES

* To impart the knowledge of structures, functions of carbohydrates.
* To describe about proteins, enzymes, mechanism of their action.
* To highlight the chemistry of oils, fats and their biological importance.
* To impart the knowledge about nucleic acid components, structures and about central dogma of life.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Explain how structure of carbohydrates determines their reactivity and biological functions.
  + Illustrate the concepts of enzyme, proteins and their acting mechanism along with their biological importance.
  + Demonstrate the lipid metabolic pathways, their inter-relationship and biological implications.
  + Interpret the concept of genetic code, central dogma of life process.

**MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES**

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| --- | --- | --- | --- | --- |
| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
| **CO 1** |  |  |  |  |
| **CO 2** |  |  |  |  |
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| **ORGANIC CHEMISTRY PRACTICAL- III** | |
| **Course Code: 23CYBS551** | Continuous Evaluation: 60 Marks |
| **Credits: 2** | End Semester Practical Examination: 40 Marks |
| **L T P : 0 0 4** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES (CO)

* To discuss the qualitative analysis of unknown organic compounds containing simple functional groups.
* To impart the practical experience about organic preparation and selective reduction.

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Perform qualitative analysis of unknown organic compounds containing simple functional groups.
* Employ the practical experience about organic preparation and selective reduction.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNINGOUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | |
| **CLO 1** | **CLO 2** |
| **CO 1** |  |  |
| **CO 2** |  |  |

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| **PHYSICAL CHEMISTRY PRACTICAL-IV** | |
| **Course Code: 23CYBS552** | Continuous Evaluation: 60 Marks |
| **Credits: 2** | End Semester Practical Examination: 40 Marks |
| **L T P : 0 0 4** | **Course Type: Core Course** |

### COURSE OBJECTIVES (CO)

### To understand the basics of electrochemical instruments.

### To impart the knowledge about the working principle of pH meter and potentiometer by different combination of acid, base and buffer solutions.

### To discuss the verification of the Freundlich and Langmuir isotherms

### COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Determine the cell constant and conductivity by conduct meter.
  + Describe the concept of buffer solution and working principle of pH meter, potentiometer and its applications.
  + Describe the adsorption properties of some acids.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| --- | --- | --- | --- |
| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | |
| **CLO 1** | **CLO 2** | **CLO 3** |
| **CO 1** |  |  |  |
| **CO 2** |  |  |  |
| **CO 3** |  |  |  |

# Semester-VI

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| **Organic Chemistry-IV (Spectroscopy and its Applications)** | |
| **Course Code: 23CYBS601** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES:

* To discuss the knowledge of basic principle of Spectroscopy, electromagnetic radiation, electronic transition and its applications.
* To illustrate the identification of different functional group of various classes of compounds.
* To make students familiar with basic principles of NMR and its applications.
* To impart the knowledge of mass Spectroscopy and how to determine the mass of compounds.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course students will be able to

* Describe the basic principle of spectroscopy, electromagnetic radiation, electronic transition and its applications.
* Identify the different functional group of various classes of compounds.
* Explain the basic principles of NMR and its applications for the characterization of compounds.
* Demonstrate the Mass Spectroscopy and determination of the mass of compounds.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNINGOUTCOMES

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| --- | --- | --- | --- | --- |
| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
| **CO 1** |  |  |  |  |
| **CO 2** |  |  |  |  |
| **CO 3** |  |  |  |  |
| **CO 4** |  |  |  |  |

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| **PHYSICAL CHEMISTRY-V (Fundamentals of Molecular Spectroscopy)** | |
| **Course Code: 23CYBS602** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

##### COURSE OBJECTIVES:

* To impart the knowledge about the interaction of electromagnetic radiation with molecule and spectra of molecules.
* To describe the concept of various vibrational spectroscopy their principles, selection rules and spectra.
* To be familiar with the concept, applications and limitation of Raman Spectroscopy and various types of electronic spectroscopy and its applications.
* To understand the concept & applications of NMR, ESR for the characterization of molecules.

##### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Describe the concepts behind molecular and rotational spectroscopy.
* Explain the concepts of vibrational spectroscopy in explaining the properties of molecules.
* Illustrate Raman spectroscopy and electronic spectra.
* Interpret the NMR and ESR spectra for the characterization of molecules/radicals.

##### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
| **CO 1** |  |  |  |  |
| **CO 2** |  |  |  |  |
| **CO 3** |  |  |  |  |
| **CO 4** |  |  |  |  |

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| **Fundamentals of Quantum Chemistry** | |
| **Course Code: 23CYBS603** | Continuous Evaluation: 60 Marks |
| **Credits: 4** | End Semester Examination: 40 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES:

* To understand the postulates of quantum chemistry
* To apply the concept of quantum chemistry in simple chemical systems
* To be familiar with the qualitative treatment of hydrogen atom and hydrogen-like ions
* To explain the LCAO-MO treatment of homo-nuclear and heteronuclear diatomic molecules.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Describe the postulates of quantum chemistry.
* Formulate and solve Schrodinger wave equation for simple chemical systems.
* Determine the probability distribution, and energy of hydrogen and hydrogen-like atoms.
* Elucidate the LCAO-MO treatment of homo-nuclear and heteronuclear diatomic molecules.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| --- | --- | --- | --- | --- |
| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
| **CO 1** | √ |  |  |  |
| **CO 2** |  | √ |  |  |
| **CO 3** |  |  | √ |  |
| **CO 4** |  |  |  | √ |

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| **COMPUTER FOR CHEMISTS** | |
| **Course Code: 23CYBS605** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 2 0 2** | **Course Type: Core Corse (Minor)** |

### COURSE OBJECTIVES

* To understand the basic applications of computer in chemistry.
* To make students familiar with programming language in chemistry.
* To explain the use of computer applications in chemistry.
* To execute some computer programming in chemistry.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Describe basics applications of computer in chemistry.
* Explain the programming language
* Illustrate the applications of computers in chemistry.
* Execute computer programming in chemistry.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| --- | --- | --- | --- | --- |
| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
| **CO 1** |  |  |  |  |
| **CO 2** |  |  |  |  |
| **CO 3** |  |  |  |  |
| **CO 4** |  |  |  |  |

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| **Practical Organic Chemistry-IV** | |
| **Course Code: 23CYBS651** | Continuous Evaluation: 60 Marks |
| **Credits: 2** | End Semester Examination: 40 Marks |
| **L T P : 0 0 4** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES

* To illustrate how to purify of liquid and solid organic substances/compounds for further characterization.
* To discuss and interpret the recorded spectra by FTIR, NMR & UV-Vis Spectroscopy.

### COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Demonstrate the purification process of liquid and solid organic compounds.
* Analyze different spectra obtained by FTIR, NMR & UV- Vis Spectroscopy for the identification of compounds/substances.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | |
| **CLO 1** | **CLO 2** |
| **CO 1** |  |  |
| **CO 2** |  |  |

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| **PRACTICAL PHYSICAL CHEMISTRY -V** | |
| **Course Code: 23CYBS652** | Continuous Evaluation: 60 Marks |
| **Credits: 2** | End Semester Practical Examination: 40 Marks |
| **L T P : 0 0 4** | **Course Type: Core Course (Major)** |

### COURSE OBJECTIVES:

* 1. To understand the working principle of Colorimetry.
  2. To be familiar with the adsorption by Freundlich and Langmuir isotherm.
  3. To understand the working principle of UV-Visible spectrum.

### COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Determine the concentration of unknown solution of CuSO4/KMnO4/K2Cr2O7.
2. Calculate λmax values and J values.
3. Find out the dissociation constant of indicators.

### MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | |
| **CLO 1** | **CLO 2** | **CLO 3** |
| **CO 1** |  |  |  |
| **CO 2** |  |  |  |
| **CO 3** |  |  |  |

**Semester-VII**

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| **Reagents and Chemical Process** | |
| **Course Code: 23CYBS701** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 3 0 1** | **Course Type: Core Course (Major)** |

**COURSE OBJECTIVES (CO):**

* + To understand the important organic name reactions and which are crucial for the synthesis of valuable organic compounds.
  + To study the role of various reducing reagents in various organic reactions for the synthesis of chemo-, diastereo- and enantio-selective products
  + To describe the role of various oxidizing reagents mechanism and their applications in various organic reactions
  + To explain the various chemical processes for industrial applications

## COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Illucidate the reaction mechanism and their practical demonstration of the name and coupling reactions
* Explain the role of the reagents in organic synthesis and apply these reagents for the bulk chemical synthesis
* Describe the application of various reagents for selective synthesis organic products
* Demonstrate the techniques for chemical processes and will enhance skills for human resource development for the chemical industry

## MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
| **CO 1** |  |  |  |  |
| **CO 2** |  |  |  |  |
| **CO 3** |  |  |  |  |
| **CO 4** |  |  |  |  |

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| **Polymers and Colloidal Chemistry** | |
| **Course Code: 23CYBS702** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 3 0 1** | **Course Type: Core Course (Major)** |

**COURSE OBJECTIVES (CO):**

* + The objective of this course is to give students a comprehensive coverage of important physical aspects of polymers chemistry and their synthesis.
  + To help the student to know properties and applications of polymers.
  + This course aims to give students a comprehensive coverage of important physical aspects of colloidal chemistry and their properties
  + To study emulsions, surfaces and interfaces and their applications.
  + To study important characterization of colloidal particles.

## COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Explain the types of polymers, kinetics of polymerization and polymer properties.
* Understand and apply the concepts of properties of polymer solutions and their thermodynamics.
* evaluate kinetic chain length of polymers based on their mechanism • differentiate between polymers and copolymers
* Comprehend the basic concepts of surface chemistry specifically in relation to colloids
* Understand and apply the important characterization of colloidal particles

## MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** | **CLO5** |
| **CO 1** |  |  |  |  |  |
| **CO 2** |  |  |  |  |  |
| **CO 3** |  |  |  |  |  |
| **CO 4** |  |  |  |  |  |
| **CO 5** |  |  |  |  |  |

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| **GREEN CHEMISTRY** | |
| **Course Code: 23CYBS703** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Major)** |

**COURSE OBJECTIVES:**

* To impart the students’ knowledge about the basic concept Green Chemistry
* To describe the importance of Green Chemistry in today’s world and it’s impact on environment.
* To illustrate the role of green solvent for the preparation of different molecules.
* To be familiar with the synthesis of different molecules by efficient method of Green Chemistry approaches.

**COURSE LEARNING OUTCOMES**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Describe the twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances.
* Perform stoichiometric calculations and relate them to green chemistry metrics. Understand benefits of use of catalyst and bio catalyst, use of renewable feed stock which helps in energy efficiency and protection of the environment, renewable energy sources.
* Design safer chemical, products and processes that are less toxic, than current alternatives.
* Demonstrate that chemistry can be used to solve rather than cause environmental problems.

**MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES**

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| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
| **CO 1** |  |  |  |  |
| **CO 2** |  |  |  |  |
| **CO 3** |  |  |  |  |
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| **Energy & Environment** | |
| **Course Code: 23CYBS704** | Continuous Evaluation: 40 Marks |
| **Credits: 2** | End Semester Practical Examination: 60 Marks |
| **L T P : 2 0 0** | **Course Type: Core Course (Minor)** |

**COURSE OBJECTIVES:**

* To develop basic understanding of energy, issues related to energy, importance of energy in terms of economy, health and the environment.
* To understand different sources of energies, renewable and non-renewable sources of energy.
* To learn the importance of green fuels.

**COURSE LEARNING OUTCOMES:**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + - Describe and Account for basic energy concepts conventional and renewable energy technologies and their application
    - Reflect and evaluate the environmental impact of energy production and the relationship between energy production, consumption and climate change
    - Analyse energy costs, the consequences of today’s energy consumption and use of renewable energy

**MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES**

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| --- | --- | --- | --- |
| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | |
| **CLO 1** | **CLO 2** | **CLO 3** |
| **CO 1** |  |  |  |
| **CO 2** |  |  |  |
| **CO 3** |  |  |  |

**SEMESTER – VIII**

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| --- | --- |
| **Novel Inorganic Solids** | |
| **Course Code: 23CYBS801** | Continuous Evaluation: 40 Marks |
| **Credits:4** | End Semester Examination: 60 Marks |
| **L T P : 3 0 1** | **Course Type: Core Course** |

**COURSE OBJECTIVES (CO):**

The exposure of this course to the undergraduates with science backgrounds can groom them for future research.

* + To understand solid state chemistry and different type of synthetic procedures.
  + To discuss the various characterization techniques of inorganic solids
  + To describe the various mixed materials and their properties.
  + To study nanomaterials, properties and their applications.
  + To analyze composites material, properties, and their applications.

## COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Discuss the mechanism of solid-state synthesis.
* Explain about the different characterization techniques and their principles.
* Describe the concept of mixed solid electrolytes and inorganic pigments
* Demonstrate the concept of nanomaterial, their synthesis, properties, and the real-world importance of bioinorganic nanomaterials.
* Explain the importance of composites and their real-life application of solid materials.

## MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| --- | --- | --- | --- | --- | --- |
| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** | **CLO5** |
| **CO 1** |  |  |  |  |  |
| **CO 2** |  |  |  |  |  |
| **CO 3** |  |  |  |  |  |
| **CO 4** |  |  |  |  |  |
| **CO 5** |  |  |  |  |  |

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| --- | --- |
| **Metals in Medicines** | |
| **Course Code: 23CYBS802** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 2 0 2** | **Course Type: Core Course** |

**COURSE OBJECTIVES (CO):**

* To be familiar about role of metal ions in biological system
* To understand Diagnostic and therapeutic agents
* To discuss the role of metal ions in drug
* To describe the role of metal ions in multivitamins
* To explain different Radiopharmaceuticals and MRI contrast agents

## COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Illustrate the role of metal ions in various biomolecules and their functions.
* Explain the role of metals in Diagnostic and therapeutic agents
* Designate the role of metals in commercially available medicines and their functions
* Describe the role of metals in multivitamins and their functions
* Elucidate the role of Radiopharmaceuticals and MRI contrast agents and their functions

## MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** | **CLO5** |
| **CO 1** |  |  |  |  |  |
| **CO 2** |  |  |  |  |  |
| **CO 3** |  |  |  |  |  |
| **CO 4** |  |  |  |  |  |
| **CO 5** |  |  |  |  |  |

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| **Inorganic Materials and its Industrial Importance** | |
| **Course Code: 23CYBS803** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 3 0 1** | **Course Type: Core Course (Minor)** |

**COURSE OBJECTIVES (CO):**

* To learns the diverse roles of inorganic materials in the industry.
* To gives an insight into how these raw materials are converted into products used in day-to-day life.
* To understand about silicates, fertilizers, for mechanical construction
* To gain knowledge about surface coatings, batteries, engineering materials for mechanical construction.
* To develop the interest of students in the frontier areas of inorganic and material chemistry.

## COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* + Describe the composition and applications of the different kinds of glass and ceramics.
  + Explain the suitability of fertilizers for different kinds of crops and soil.
  + Elucidate the process of formulation of paints and the basic principle behind the protection offered by the surface coatings.
  + Demonstrate the principle, working and applications of different batteries.
  + List and explain the properties of engineering materials for mechanical construction used in day-to-day life.

## MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** | **CLO5** |
| **CO 1** |  |  |  |  |  |
| **CO 2** |  |  |  |  |  |
| **CO 3** |  |  |  |  |  |
| **CO 4** |  |  |  |  |  |
| **CO 5** |  |  |  |  |  |

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| **Pharmaceutical Chemistry** | |
| **Course Code: 23CYBS804** | Continuous Evaluation: 40 Marks |
| **Credits: 4** | End Semester Examination: 60 Marks |
| **L T P : 4 0 0** | **Course Type: Core Course (Minor)** |

**COURSE OBJECTIVES (CO):**

* To understand students, the principles of drug action & synthesis of drugs.
* To develop various classes of antibiotics & their mode of action
* To understand the basic knowledge of Prostaglandins, Antipyretic & analgesics
* To understand the mode of action of antihypertensive & Contraceptive agents.

**COURSE LEARNING OUTCOMES (CLO):**

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

* Illustrate retro-synthesis approach in relation to drug design and drug discovery.
* Describe about various classes of antibiotics & their mode of action.
* Explain the functioning of Prostaglandins, Antipyretic-& analgesics.
* Discuss the mode of action of antihypertensive & Contraceptive agents.

**MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES**

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| --- | --- | --- | --- | --- | --- |
| Course Objectives (COs) | **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** | |
| **CO 1** |  |  |  |  | |
| **CO 2** |  |  |  |  | |
| **CO 3** |  |  |  |  | |
| **CO 4** |  |  |  |  |

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| **Artificial Intelligence and Machine Learning in Chemistry** | |
| **Course Code: 23CYBS805** | Continuous Evaluation: 40 Marks |
| **Credits: 2** | End Semester Examination: 60 Marks |
| **L T P : 1 0 1** | **Course Type: Core Course (Minor)** |
| **Prerequisite: Basic Computer Knowledge** | |

**COURSE OBJECTIVES (CO):**

* + The course is aimed at familiarization of students to modern scientific machine (programming) language i.e., Python, artificial intelligence (AI) & machine learning (ML) and their potential applications in chemistry.
  + To provide elementary ideas of the techniques prevailing in the field of artificial intelligence (AI) and machine learning (ML).
  + To understand their applications to research problems especially related to research and development of new materials and pharmaceutical compounds with desired properties.

## COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

## Conversant with the Python Programming Language.

## Familiar with Elementary techniques of Artificial intelligence (AI) &Machine learning (ML)

## Apply techniques of AI & ML in basic problems of research in some important areas of research in Chemistry.

## MAPPING COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

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| --- | --- | --- | --- |
| Course Objectives (COs) | **Course Learning Outcomes (CLOs)** | | |
| **CLO 1** | **CLO 2** | **CLO 3** |
| **CO 1** |  |  |  |
| **CO 2** |  |  |  |
| **CO 3** |  |  |  |

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| **LIVE PROJECTS & INDUSTRY VISIT** | |
| **Course Code: 23CYBS271/471** | Continuous Evaluation: 60 Marks |
| **Credits: 1** | End Semester Examination: 40 Marks |
| **Duration: Continuous** | Course Type: Skill Enhancement Course |

### LIVE PROJECT COURSE OBJECTIVES

* + To provide qualitative enhancements to the UG students of FSH.
  + Offered live projects serve to enhance students employability attributes to make them job-ready.
  + To provide experiential learning to students for an ability to work in a real-life work situation.
  + To provide a learning ground for students to get an opportunity to apply what they have learned in classes to real-world scenarios. An opportunity to work in real constraints of resources, people factors and other organizational constraints. Classroom projects are primarily focused on singular concepts whereas live projects allow integrating knowledge across various functions.
  + Live projects develop employment abilities in students and provide industry experience and insights.

### LIVE PROJECT OUTCOMES

On completion of the live project(s), students will be

* + Capable enough to exhibit strong foundation knowledge of domain area.
  + Students can take a challenge and place better career development scenario in professional life.
  + It gives a strong boost for experienced to take their career into next stage.
  + Successfully completion of live projects shows a better stand and technical expertise in domain area.

### ASSESSMENT DETAILS

Assessment of Live Project(s) & Industrial visit include the following:

* + Formative & submissive assessment.
  + During the final assessment students have to submit a hard copy of the project, the presentation has to be given by the students.
  + Prototype or Working Model, in case of Live Project is taken up for it.
  + Report on Project.
  + Viva Voce.
  + Final Presentation in front evaluation team.

### PERIODIC MONITORING

|  |  |
| --- | --- |
| **DURATION** | **Continuous Monitoring throughout the Project** |
| **EVALUATION PROCESS** | 1. Student will prepare the report on the work done. 2. Student will prepare the presentation on the learning outcomes. 3. Student will give presentation about the learning achieved. |

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| **EVALUATION** | * Formative/Continuous Evaluation: 60 % * End Semester Evaluation: 40 % |

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| **SUMMER INTERNSHIP**  (Faculty of Science, Humanities & Social Science) | |
| **Course Code: 23CYBS672** | Continuous Evaluation: 60 Marks |
| **Credits: 4** | End Semester Examination: 40 Marks |
| **Duration: 3 / 4 Weeks** | Course Type: Skill Enhancement Course |

##### COURSE OBJECTIVES

* + To have qualitative improvements in the UG students of FSH.
  + To provide experiential learning to students to work in the real-life situation.
  + Expose the student to professional role models or mentors who will provide the student with support in the early stages of the internship and provide an example of the behaviours expected in the intern's workplace.
  + Assist the student's development of employer-valued skills such as teamwork, communications and attention to detail.

##### COURSE LEARNING OUTCOMES

On completion of course, students will be

* + Able to demonstrate various aspects of theory as well as practical.
  + Able to build and expand network of professional relationships and contacts.
  + Develop a solid work ethic and professional demeanour, as well as a commitment to ethical conduct and social responsibility.
  + At the end of the course, a student will be competent in their domain area.

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| **DURATION** | **3 to 4 Weeks (After 4th Semester End Term Examination)** |
| **EVALUATION PROCESS** | 1. Student will prepare the report on the work done. 2. Student will prepare the presentation on the learning outcomes. 3. Student will give presentation about the learning achieved. |

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| **EVALUATION** | * **Formative/Continuous Evaluation: 60 %** * **End Semester Evaluation: 40 %** |

**EVALUATION PARAMETER FOR SUMMER INTERNSHIP PROJECT (SIP)**

1. **Evaluation Parameter for Formative Assessment (Summer Internship Project)**

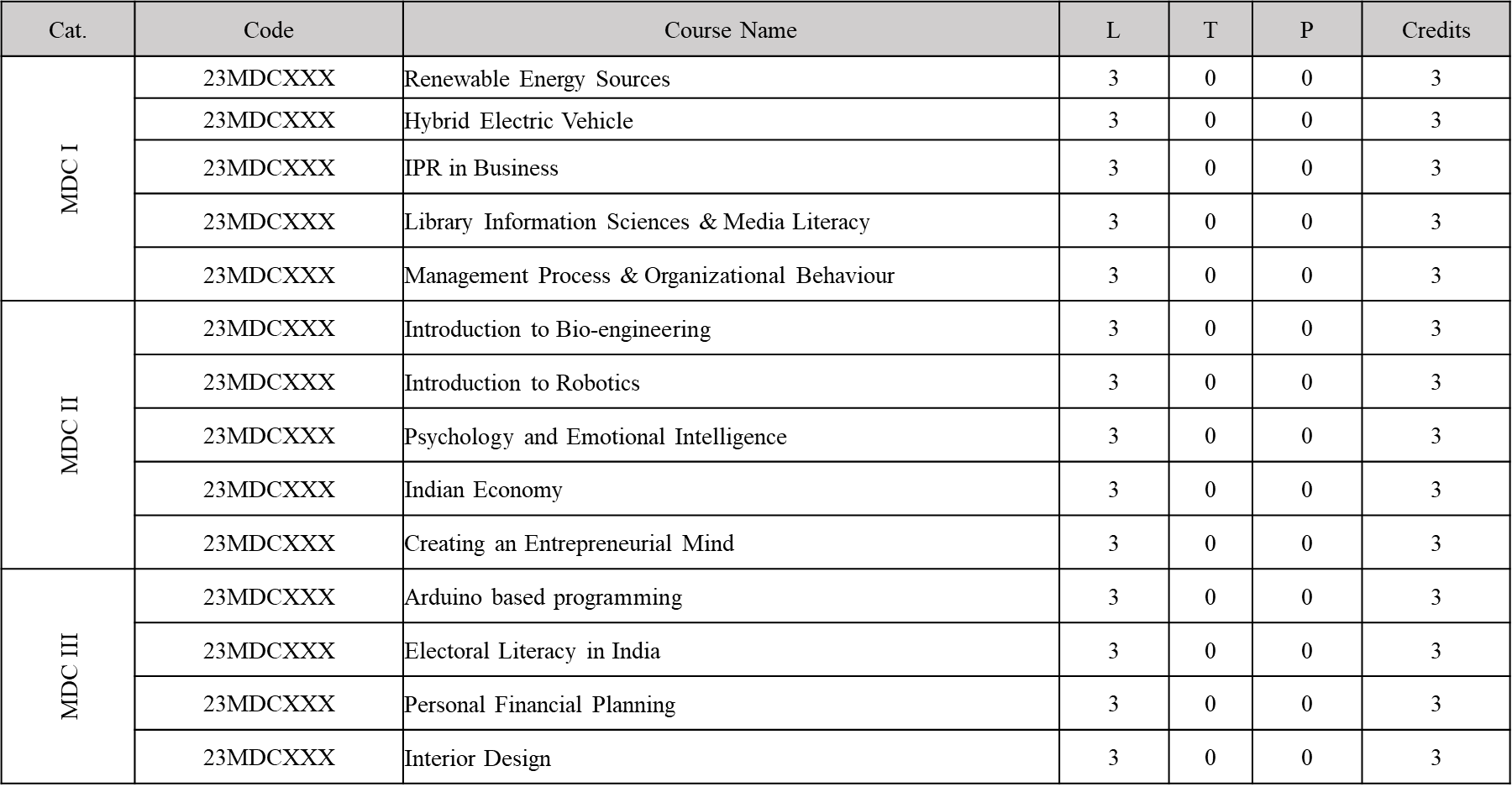
Continuous Assessment will perform by respective faculty & Industry coordinators within stipulated time period. Evaluation Parameter classified as follows:

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Basis of Evaluation Parameter with Time frame** | **Marks** |
| 1. | Synopsis Presentation (Week 1st) | 15 |
| 2. | Relevance and linkage of the Identify issue with functional area of discipline  (Week 1st) | 10 |
| 3. | Survey of Literature (Week 2nd) | 10 |
| 4. | Research Methodology & Data collection (3rd to 4th Week) | 15 |
| 5. | Overall understanding of the area of study (3rd to 4th Week onwards) | 10 |
|  | **Total Marks** | **60** |

##### Evaluation Parameter for End Term Assessment (Summer Internship Project)

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Basis of Evaluation Parameter** | **Marks** |
| 1. | Quality Of Content Design | 10 |
| 2. | Identification of Contemporary Issue | 10 |
| 3. | Innovation in learning Process | 10 |
| 4. | Presentation of Content & Delivery Mechanism | 10 |
|  | **Total Marks** | **40** |

**List of Multidisciplinary Courses (MDC)**



**List of Ability Enhancement Courses (AEC)**

|  |  |  |
| --- | --- | --- |
| **Total : 9 (3\*3) Credits** | | |
| Sl. No. | **Course Name** | **Credits** |
| 1 | Functional English-I | 3 |
| 2 | Functional English-II | 3 |
| 3 | Hindi/German/French | 3 |
| 4 | Live Project-I | 4 |
| 5 | Live Project-II | 4 |
| 6 | Summer Internship | 4 |

**List of Skill Enhancement Courses (SEC)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Courses on Soft Skills** | | | | | | |
| S. No. | Code | **Course Name** | **L** | **T** | **P** | **Credits** |
| 1 | 23SS151 | Effective Communication Skills | 0 | 0 | 2 | 1 |
| 2 | 23SS252 | Teamwork & Interpersonal Skills | 0 | 0 | 2 | 1 |
| 3 | 23SS353 | Presentation Skills | 0 | 0 | 2 | 1 |
| 4 | 23SS454 | Professional Skills | 0 | 0 | 2 | 1 |
| 5 | 23AR555 | Aptitude & Reasoning | 0 | 0 | 2 | 1 |

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| --- | --- | --- | --- | --- | --- | --- |
| **Courses on Technical Skills** | | | | | | |
| **S. No.** | **Code** | **Course Name** | **L** | **T** | **P** | **Credits** |
| 1 | 23SS101 | Digital Literacy & IT Skills | 0 | 0 | 2 | 1 |
| 2 | 23SS202 | Advanced Excel Skills | 0 | 0 | 2 | 1 |
| 3 | 23SS303 | Statistical Analysis with SPSS | 0 | 0 | 2 | 1 |
| 4 | 23SS404 | R language programming | 0 | 0 | 2 | 1 |
| 5 | 23SS505 | Programming with MATLAB | 0 | 0 | 2 | 1 |

**List of Value-Added Courses (VAC)**

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| --- | --- | --- | --- | --- | --- |
| **Total : 6 (2\*3) Credits** | | | | | |
| **University Pool (Common to all UG Students)** | | | | | |
| **Sl. No.** | **Course Name** | | | | **Credits** |
| **1** | **Indian Constitution & Polity** | **2** | **0** | **0** | **2** |
| **2** | **Environment Protection & Sustainable Development** | **2** | **0** | **0** | **2** |
| **3** | **Sports, Yoga & Fitness** | **0** | **0** | **4** | **2** |
| **NOTE:** | | | | | |
| **1. All the Courses are compulsory for the students.** | | | | | |
| **2. Students should be encouraged to enroll for NSS/NCC** | | | | | |