

# SCHEME OF TEACHING, EXAMINATION AND SYLLABUS AS PER

## NEP 2020 for M. Sc. CHEMISTRY

Choice Based Credit System (Semester Pattern) Effective from 2023-2024

### Program Specific Outcomes (PSO) – M.Sc. Chemistry

- PSO1- To have sound knowledge about the fundamentals and applications of knowledge associated with the profession of chemistry, including specialized areas of inorganic chemistry, organic chemistry, physical chemistry, analytical chemistry, and elective subject of polymer chemistry.
- PSO2- Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions. Find, analyze, evaluate and apply information systematically and to make defensible decisions. Learn, select, and apply appropriate methods and procedures resources, and modern chemistry-related to computing tools with an understanding of the limitations. Interpret analytical data for structure elucidation using NMR, IR, UV and Mass spectroscopy.
- PSO3- Understand the impact of the professional Chemistry solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development. Develop an understanding of eco-friendly chemical processes and impact of chemistry on health and environment.
- PSO4 - Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-access and use

feedback effectively from others to identify learning needs and to satisfy these needs ongoing basis.

- PSO5-Practices analytical skills such as synthesizing, separating, characterizing chemical compounds using laboratory and instrumentation techniques.
- PSO6-Grow research skills through dissertation/Project work in diverse fields of chemistry such as organic, nanoscience, analytical, physical etc. Review scientific literature and findings in methodical manner and dealing out of information obtained to comprehend scope for originality.
- PSO7 - Obtain cutting-edge level of familiarity in natural products as well as various biological systems from the Chemical biology aspects.
- PSO8 - Develop responsiveness in academic and research ethics, scientific misconduct, misrepresentation and manipulation of data. Coherent communication skills through seminars and the accumulating of information in the form of assignments. Create potential to participate for the available employment opportunities or work independently in research, industries and other analytical based fields.

## **SEMESTER I**

### **Paper 1**

#### **MCH1T01: Inorganic Chemistry**

##### **Course Outcomes (COs):**

**At the end of the course students would be able to**

- Predict the nature of bond and its properties through various electronic structural methods; bonding models

- Design new coordination compounds based on a fundamental understanding of their electronic properties
- Develop the possible catalytic pathways leading to desired products
- Apply the principles of transition metal coordination complexes to derive reaction mechanisms.

## **Paper 2**

### **MCH1T02: Physical Chemistry**

#### **Course Outcomes (COs):**

**At the end of the course students will be able to applications**

- Understand, analyze and exercise the principles of classical thermodynamics in various
- Understand and execute the quantum mechanical problems and their applications
- Understand the concept of adsorption and its application in surface chemistry
- Analyze and understand the characterization techniques for polymer
- Understand the principles of chemical kinetics and their applications in chemical dynamics

## **SEMESTER I**

### **Paper 3 (Elective)**

#### **MCH1T03: (a) Bioinorganic Chemistry**

- Apply the principles of transition metal coordination complexes in understanding

**Course Outcomes: At the end of the course, student would be able to**

- Functions of biological systems
- Identify the medicinal applications of inorganic compounds

- Understand mechanism of energy transfer processes in biological systems
- Develop the possible enzymatic pathways in biosystems
- Explain oxygen transport mechanisms in biosystems

### **Paper 3 (Elective)**

#### **MCH1T03: (b) Biomolecules**

**Course Outcomes: At the end of the course students would be able to**

- Draw the structures of essential biomolecules
- Understand the role of biomolecules in various life processes
- Understand the way how drug can be administered, absorbed, distributed and metabolized
- Understand the relation of drug with different types of receptors, chemical messengers, binding site and DNA.

### **Paper 3 (Elective)**

#### **MCH1T03: (c) Foundations of Thermodynamics and Electrochemistry**

**Course Outcomes (COs):**

**At the end of the course students will be able to**

- Understand, the mathematical concepts used in chemistry
- Understand the principle involved in fundamental physical chemistry
- Understand the concept of ideal and non-ideal solutions
- Understand the theories of electrolytes

### **Paper 3 (Elective)**

#### **MCH1T03: (d) Analytical Separation Techniques**

**Course Outcomes (COs):**

**At the end of the course students will be able to**

- Understand various separation technique based on sample and target analyte
- Elaborate the working principles of various separation techniques.
- Apply logic behind working and applicability of each technique.
- Identify most suitable separation tool resolution of mixtures.
- Develop separation methods for multicomponent analysis.
- Evaluate efficiency of separation of mixture based on analysis parameters.

## **SEMESTER I**

### **Paper 4**

#### **MCH1T04: Research Methodology**

##### **Course Outcomes (COs):**

**At the end of the course, student will be able to understand**

- What research is and what is not raise awareness of crucial aspect of the nature of Knowledge and the value of scientific method.
- Introduce the concept at the heart of every research project the research problem and to discuss what a researchable problem is evaluate literature, form a variety of sources, pertinent to the research objectives identify and justify the basic components of the research framework, relevant to the tackled research problem.
- Explain and justify how researchers will collect research data.
- Discuss how to cite sources, and justify this choice.
- Put forward a credible research proposal, and warn the common mistakes in the field of research methodology.

## **Practical 2**

### **MCH1P02: Physical Chemistry including RM**

#### **Course Outcomes (COs):**

**At the end of the course students would be able to**

- Understand the basic principle involved in physical chemistry.
- Evaluate various physical parameters
- Interpret the experimental results.
- Calculation involved in interpreting results

## **Paper 3 (Elective)**

### **MCH1T03: (b) Biomolecules**

#### **Course Outcomes (COs):**

**At the end of the course students would be able to**

- Draw the structures of essential biomolecules
- Understand the role of biomolecules in various life processes
- Understand the way how drug can be administered, absorbed, distributed and metabolized
- Understand the relation of drug with different types of receptors, chemical messengers, binding site and DNA.

## **Paper 4**

### **MCH1T04: Research Methodology**

#### **Course Outcomes (COs):**

**At the end of the course, student will be able to**

- Understand what research is and what is not.
- Raise awareness of crucial aspect of the nature of Knowledge and the value of scientific method.
- Introduce the concept at the heart of every research project the research problem and to discuss what a researchable problem is.

- Evaluate literature, from a variety of sources, pertinent to the research objectives.
- Identify and justify the basic components of the research framework, relevant to the tackled research problem.
- Explain and justify how researchers will collect research data.
- Discuss how to cite sources, and justify this choice.
- Put forward a credible research proposal, and
- Warn the common mistakes in the field of research methodology.

## **Practical 2**

### **MCH1P02: Physical Chemistry including RM**

#### **Course Outcomes (COs):**

**At the end of the course students would be able to**

- Understand the basic principle involved in physical chemistry.
- Evaluate various physical parameters
- Interpret the experimental results.
- Calculation involved in interpreting results
- Understand the concept of Qualitative analysis

## **SEMESTER II**

## **SEMESTER II**

### **Paper 5**

#### **MCH2T05: Organic Chemistry**

#### **Course Outcomes (COs):**

**At the end of the course students will be able to**

- Implement rules of aromaticity to organic molecules
- Sketch organic molecules in different projection formula and assign its configuration.

- Apply their understanding about the organic reactions of industrial significance with respect to the chemo- selectivity, regioselectivity and enantioselectivity.
- Analyze the product distribution and the stereochemistry of various organic products.
- Evaluate the relationship between structure and reactivity

## **SEMESTER II**

### **Paper 6**

#### **MCH2T06: Analytical Chemistry**

##### **Course Outcomes (COs):**

**At the end of the course students will be able to**

- Select a specific analytical technique based on sample and target analyte
- Develop analytical ability and critical thinking in selection of statistics and their use in making interpretation meaningful and productive.
- Explain the logic behind working of indicator used in each type of titration
- Elaborate interaction of radiation with matter and its application in chemical analysis.
- Develop spectral methods of analysis for desired analytes.
- Apply electroanalytical techniques based on conductance and emf measurements.

## **SEMESTER II**

### **Paper 7 (Elective)**

#### **MCH2T07: (a) Solid state and organometallic chemistry**

##### **Course Outcomes (COs):**



**At the end of the course, student would be able to**

- Understand the structures of various types of solids.
- Establish structure-property correlation in solids.
- Unravel and interpret the structural aspects of metal clusters.
- Explain structures and applications of organotransition compounds,
- Predict the mechanism of complex reactions.
- Establish the thermodynamic and kinetic stability of reactants and products in complex reactions.

## **SEMESTER II**

**Paper 7 (Elective)**

**MCH2T07: (a) Solid state and organometallic chemistry**

**Course Outcomes (COs):**

**At the end of the course, student would be able to**

- Understand the structures of various types of solids.
- Establish structure-property correlation in solids.
- Unravel and interpret the structural aspects of metal clusters.
- Explain structures and applications of organotransition compounds,
- Predict the mechanism of complex reactions.
- Establish the thermodynamic and kinetic stability of reactants and products in complex reactions.

## **SEMESTER II**

**Paper 7 (Elective)**

**MCH2T07: (b) Organic Reaction Mechanism**

**Course Outcomes (COs):**

**At the end of the course students will be able to**

- Predict the orientation and stereochemistry of the product of addition and elimination reaction
- Apply enolate chemistry to achieve molecular complexity
- Design organic reactions in order to achieve the required product(s)
- Formulate green chemistry synthesis to increase atom economy
- Application of free radicals in functional group transformation

#### **Paper 7 (Elective)**

#### **MCH2T07: (c) Quantum, Statistical and Nuclear Chemistry**

#### **Course Outcomes (COs):**

**At the end of the course students will be able to**

- Understand the concept of statistical thermodynamics and their uses.
- Understand the quantum mechanical applications in actual practice and in spectroscopy
- Understand the thermodynamics of real processes
- Understand the distribution laws and their applications
- Understand the fundamentals of Nuclear sciences

#### **SEMESTER II**

#### **Paper 7 (Elective)**

#### **MCH2T07: (d) Instrumental Methods of Analysis**

#### **Course Outcomes (COs):**

**At the end of the course students will be able to -**

- Understand the importance of sampling and sample treatment.
- Select appropriate sampling technique based on sample and target analyte.
- Explain principle and instrumentation involved in AAS.

- Deduce the necessity to remove interferences in AAS and methods involved.
- Select proper technique among the available techniques.
- Formulate experiments based on optical and electroanalytical techniques.

## **SEMESTER II**

### **Practical 3**

#### **MCH2P03: On Job Training/Field Project**

- On job training or a Field Project is a skill based practical program. It has to be carried out in accordance

## **SEMESTER II**

### **Practical 4**

#### **MCH2P04: Organic Chemistry**

##### **Course Outcomes (COs):**

**At the end of the course students would be able to**

- Handling of the hazardous chemicals by safely
- Predict and analysis of the major and minor products of a variety of organic reactions
- Monitoring of the chemical reactions
- Calculation of yield, percentage yield of the chemical reactions
- Understand the concept of Qualitative analysis

### **Practical 5**

#### **MCH2P05: Analytical Chemistry**

##### **Course Outcomes (COs):**

**At the end of the course, student will be able to**

- Carry out calibration of glassware available in the laboratory.
- Analyze the data obtained through experiments using statistical analysis parameters.
- Estimate quantitatively analyte present in different samples using classical and instrumental methods of analysis.
- Design experiments based on classical and instrumental techniques.
- Understand the principles involved in visual and instrumental volumetric techniques.
- Formulate experiments based on optical and electro analytical techniques