

**B.Sc. (NEP) SEMESTER-IV  
(THEORY)**

|                                                  |                 |                    |
|--------------------------------------------------|-----------------|--------------------|
| <b>Programme: Certificate In Chemistry</b>       | <b>Year: II</b> | <b>Semester-IV</b> |
| <b>Course Code:</b> CHE(N)-202                   |                 |                    |
| <b>Course Name:</b> General Chemistry-II         |                 |                    |
| <b>Credit:</b> 3                                 |                 |                    |
| <b>Max. Marks:</b> 70 (Theory) + 30 (Assignment) |                 |                    |

**Course Objective and Outcomes:**

Learners will gain an understanding of

- Detailed knowledge of synthesis of carboxylic acids; nitrogen containing compounds and functional groups inter conversion. The learners will be able to describe the concepts of inner transition elements and electrochemistry in detail and its applications. Also, they will be able to solve the numerical problems based on these concepts. Learners will be able to define the acids and bases on the basis of various concepts/ theories and will be able to identify the position of various elements in the periodic table and able to explain their properties on the basis of their position.

**Syllabus Details**

**Block-1: Inner transition element and acids-base**

**Unit 1: Chemistry of inner transition element-I (Lanthanides)**

Electronic structure, oxidation state and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

**Unit 2: Chemistry of inner transition element-II (Actinides)**

General feature and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the latter actinides and the latter lanthanides.

**Unit 3: Acid and base General concept of acid and base**

Theory of acid and base- Arrhenius, Bronsted- Lowry, the Lux Flood, Solvent system and Lewis's concept of acids and base.

**Block-II: Carboxylic functional group containing compounds**

**Unit 4: Carboxylic acid**

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids effect of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids. Hydroxy acids: malic, tartaric and citric acids.

**Unit 5: Acid Anhydrides**

Structure and nomenclature of acid anhydrides. Physical and chemical properties of acid anhydrides.

**Unit 6: Acid Halides**

Structure and nomenclature of acid halides. Physical and chemical properties of acid halides.

### **Unit 7: Ester**

Structure and nomenclature of esters. Physical and chemical properties of ester. Block-III: Nitrogen-containing compounds

### **Unit 8: Nitro compounds**

Introduction and preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline media. Picric acid.

### **Unit 9: Amines**

Structure and nomenclature of amines, physical properties, Stereochemistry of amines Separation of a mixture of primary, secondary and tertiary amines, Structural features affecting basicity of amines, Preparation of alkyl and aryl amines, Reduction amination of aldehydic and ketonic compounds, Gabriel phthalimide synthesis, Hofmann bromination reaction.

## **Block-IV: Thermochemistry and Electrochemistry**

### **Unit10: Thermochemistry**

Introduction, Standard state, Standard enthalpy of formation, Hess law and its applications, Heat of reaction at constant pressure and constant volume, Enthalpy of neutralization, Bond dissociation energy and its calculation, Temperature dependence of enthalpy, Kirchhoff's equation

### **Unit 11: Electrochemistry-I**

Electrical transport- conduction in metal and in an electrolyte solution, specific conductance and equivalent conductance, measurement of equivalent and specific conductance with dilute. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations. Debye- Huckel- Onsager's equation for strong electrolytes. Transport number, definition and determination by Hittorf method and moving boundary method. Application of conductivity measurements: determination of degree of dissociation, determination of  $K_a$  of acids, determination of solubility product of sparingly soluble salt, conductometric titrations.

### **Unit 12: Electrochemistry-II**

Types of reversible electrodes- gas-metal ion, metal-metal ion, and metal insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode reference electrodes- standard electrode potential, single conventions, electrochemical series and its significance.

**SEMESTER-IV**  
**(PRACTICAL)**

|                                            |                 |                    |
|--------------------------------------------|-----------------|--------------------|
| <b>Programme: Certificate In Chemistry</b> | <b>Year: II</b> | <b>Semester-IV</b> |
| <b>Course Code: CHE(N)-202 L</b>           |                 |                    |
| <b>Course Name: Laboratory Course-IV</b>   |                 |                    |
| <b>Credit: 1</b>                           |                 |                    |
| <b>Max. Marks: 50</b>                      |                 |                    |

**Course Objective and Outcomes:**

- After completing this course, the students will be able to determine the concentrations of oxidising and reducing agents through double titration, qualitatively differentiate between carboxylic acids, ester, nitrogen containing compounds and determine the Critical solution temperature and kinetics.

**Syllabus Details**

**Block-1: Laboratory hazards and safety**

**Unit 1: Laboratory hazards and safety precautions**

Laboratory hazards and safety precautions

**Block-2: Experiment**

**Unit 2: Inorganic exercise:** Volumetric exercises (double titration)

Volumetric exercises (double titration) based on redox reactions involving internal as well as external indicators.

**Unit 3: Organic exercise:** Chemical, physical and functional group tests

Preliminary and functional group tests for carboxylic acids, ester and nitro compounds (both aliphatic and aromatic).

**Unit 4: Physical exercise:** Critical solution temperature and kinetics

Determination of critical solution temperature (CST) and Kinetics of acid catalysed

**Distribution of marks shall be as given below:**

- |    |                                                                |   |    |
|----|----------------------------------------------------------------|---|----|
| 1. | Inorganic exercise                                             | : | 12 |
| 2. | Organic exercise                                               | : | 12 |
| 3. | Physical exercise                                              | : | 11 |
| 4. | Viva                                                           | : | 05 |
| 5. | Home assignment/internal assessment, lab record and attendance | : |    |