Board of Studies I
Morigaon College (Autonomous)
Department of chemistry.

Date: 22/11/25 Time: 11 am.

Venue: chemistry Department.

Agenda:

1) Syllabus discussion.
2) Structure of credit system.
3) Subject combination.
4) Off Overall all Discussion on offering new Syllabus of SEC and MDC courses.

Resolutions:

1) The Program Outcome and Course Outcome should be mentioned in both Semester I and Semester II syllabus.

2) The syllabus content for Semester I and Semester II were rationalized keeping in view the Proposed learning outcome of the Prospective students of chemistry (Both major & minor).

3) The committee has recommended the following modification in the proposed syllabus:

For Semester-I — i) modification in unit II
ii) Periodicity should be a separate subsection.

For Semester II

3) Restructuring of Unit II, Unit V & Unit VI. The highlighted contents need to be incorporated in the syllabus ~~made for~~ meant for higher semesters.

4) Balancing of contents for Organic, Inorganic and Physical chemistry in the syllabus.

5) The learning outcome & course outcome should be mentioned in syllabus designed for practical courses.

6) The practical components for semester I & semester II may be recognise in the following manner.

for eg:

Sem-I – Physical - Inorganic or Physical organic

Sem-II. Physical - Organic or Physical inorganic.

7) The SEC papers should be focused on applying chemistry skills in real time applications. It is suggested that the course reflects the emerging challanges in industry, agriculture and related areas.

8) It is recommended that the MDC course, should be designed in a way that the students learns about the manifestation of chemical principles in related disciplines like; Economics, History, industry and engineering ~~& commerce~~.

Signatures:

1) Dr. Arunima Sarma (chairperson)
HOD, Chemistry)

Signature: Arunima Sarma / 22/11/2025

2) Prof. Rupam Jyoti Sarma. (VC's nominee)
HOD, chemistry, Gauhati University.

Signature: 22/11/25

3) Prof. Ghanashyam Bez. (Subject Expert)
Department of chemistry.
North-Eastern Hill university 22/11/2025

Signature:

4) Prof. Manjit Bhattacharyya. (Subject expert)
Department of chemistry,
Cotton university

Signature: 22/11/25

5) Mr. Chandra Kanta Bora. (Industry Expert)
Director, Progressive Fentichim (P) Ltd.

Signature: Chandra Kanta Bora.

Semester-I

Paper Name/Title: Chemistry I

Course Code: CHE-CORE-(MJ/MN)-MC-0100104

Credits = 4 (Theory 3 Practical 1)

(External Evaluation 45 + Internal Assessment 30 + Practical 25): Total Marks 100

Learning Objectives: *This course is designed to give students a solid understanding of the structure and behaviour of atoms, molecules, and materials. You will explore how our understanding of the atom developed, from Bohr's model to the quantum-mechanical picture, including hydrogen spectra, black-body radiation, and the photoelectric effect. The course also introduces the dual nature of matter and the principles that govern electron arrangements in atoms and orbitals.*

You will learn how elements show periodic trends, such as ionization energy, electronegativity, and atomic size, and how these influence chemical behaviour. In bonding, the focus will be on ionic compounds, their lattice and solvation energies, and ways to calculate them. Organic chemistry topics will cover hybridization, molecular structures, stereochemistry, and conformational analysis.

Physical chemistry topics like real-gas behaviour, van der Waals equation, critical phenomena, and liquid properties including surface tension, viscosity, and micelle formation will also be explored. The course aims to build your ability to think critically and understand the molecular world.

Semester-I **Paper Name/Title: Chemistry I**

Unit	Content	Contact Hours
Unit I: Atomic structure	Historical development on structure of atom; Bohr's model, H-atom spectrum; black body radiation; photoelectric effect (qualitative treatment only); The dual behaviour and uncertainty. Quantum mechanical approach to atomic structure: concept of wave function, well behaved function, operator, normalised and orthogonal wave functions, Schrodinger wave equation, eigenfunction, Significance of ψ and ψ^2, Schrodinger equation of hydrogen atom (no derivation), radial and angular wave functions for hydrogen atom, shapes of *s, p, d* and *f* orbitals. Probability distribution, quantum numbers, Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.	8
Unit II Periodicity and chemical behaviour	Periodicity of the elements: Effective nuclear charge; Slater's Rule; covalent and ionic radii, ionization energies, electronegativity (various scales), electron affinities.	3

Unit III: Chemical Bonding (Ionic Bonding)	General characteristics of ionic compounds; lattice and solvation energy; Born Lande equation; Kapustinski equation, Madelung constant, Born Haber cycle for lattice energy calculation.	4
Unit IV: Structure of organic molecules	Nature of bonding: hybridization of atomic orbitals (qualitative VB and MO approach); effect of hybridization on bond properties.	3
Unit V: Stereochemistry of organic molecules	Configuration and conformation of organic molecules; Representation of organic molecules in 2D and 3D (Fischer, Flying wedge, Newman and Sawhorse projection formulae and their interconversions); geometrical isomerism (cis-trans, syn-anti, E/Z notations); concept of chirality (enantiomers, diastereomers and meso structures); Relative and absolute configuration: D/L and R/S designations; barriers to rotation, Baeyer strain theory, conformational analysis (ethane, butane, cyclohexane).	8
Unit VI: Basic Organic Chemistry	Electronic effects in organic molecules: inductive effects; resonance, conjugation and delocalization, hyperconjugation and their application; dipole moment; Concept of electrophiles and nucleophiles.	4
Unit VII: Gaseous state	Causes of deviation from ideal gas behaviour, compressibility factor, Z, and its variation with pressure and temperature for different gases. State variables and equation of states for real gases; vander Waals equation of state, its derivation and applications, examples, Equation of state and isotherm. Critical state and phenomena, critical point, relation between critical constants and vander-Waals constants: along with their thermodynamic interpretation. Introduction to virial equation and virial coefficients, derivation of Boyle temperature.	8
Unit VIII: Liquid state	Qualitative treatment of the structure of the liquid state. Physical properties of liquids: vapour pressure, surface tension coefficient of viscosity, and their determination, effect of temperature and comparison with that of gases. Effect of addition of various solutes on surface tension and viscosity. micelle formation and critical micelle concentration.	7

Laboratory Course I

Group A

1. Surface tension measurements.

a) Determine the surface tension of a given liquid by means of stalagmometer using (i) drop number method (ii) drop weight method.

b) Study the variation of surface tension of detergent solutions with concentration.

2. Viscosity measurement using Ostwald's viscometer.

a) Determination of viscosity of liquid at a given concentration at room temperature.

b) Study the variation of viscosity of sucrose solution with the concentration of solute.

Group B

1. Purification of organic compounds by crystallization using the following solvents:

(a) water, (b) alcohol, (c) alcohol-water mixture

2. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds.

3. Detection of unsaturation and aromaticity in an organic sample.

Course Outcomes (CO)

Upon successful completion of the course, students will be able to:

1. Explain atomic structure and the fundamentals of quantum mechanics, including Bohr's model, experimental evidence, the Schrödinger equation, atomic orbitals, quantum numbers, and the principles governing electronic configurations.
2. Analyze periodic trends using effective nuclear charge and Slater's rules to predict variations in atomic and ionic properties.
3. Evaluate ionic bonding and lattice energy by applying the Born–Lande and Kapustinskii equations, Madelung constants, and the Born–Haber cycle.
4. Describe bonding and molecular structure in organic compounds using hybridization and qualitative Valence Bond and Molecular Orbital approaches, and relate these to molecular geometry and properties.
5. Interpret molecular stereochemistry, including projection formulae, chirality, and optical activity.
6. Assess the influence of electronic effects—inductive, electromeric, resonance, and mesomeric—on the stability, acidity, basicity, and reactivity of organic compounds.
7. Explain the behavior of real gases, including deviations from ideality, the van der Waals equation, compressibility factor, critical constants, the virial equation, and Boyle temperature.
8. Describe the structure and properties of liquids, including vapour pressure, surface tension, viscosity, micelle formation, and critical micelle concentration.
9. Apply basic laboratory techniques to measure surface tension and viscosity, purify organic compounds by crystallization, analyze melting-point behavior, and identify unsaturation and aromaticity.

Semester-I

Skill Enhancement Course (SEC)

Paper Name/Title: Basic Analytical Chemistry

Course Code: SEC-CHE-MC-0100103

Credits = 3 (Theory 2 Practical 1)

(External Evaluation 30 + Internal Assessment 20 + Practical 25): Total Marks 75

Learning Objectives: *The objective of this course is to introduce students to the fundamental principles and applications of analytical chemistry, with emphasis on sampling techniques, accuracy, precision, and error analysis in chemical measurements. The course aims to develop an understanding of quantitative analytical methods for the estimation of metal ions and determination of metal complex composition. It also seeks to provide knowledge of soil, water, and food analysis, including pH measurement, hardness, dissolved oxygen, adulteration, and preservation. Additionally, the course familiarizes students with chromatographic techniques such as paper chromatography and thin-layer chromatography for separation and analysis of chemical substances, while developing practical laboratory skills relevant to environmental and food chemistry.*

Semester-I **Paper Name/Title: Basic Analytical Chemistry**

Unit	Content
Unit I: Introduction	Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.
Unit II: Basic principles of quantitative analysis	Estimation of metal ions from aqueous solution, geometrical isomer, keto-enol tautomers, determination of metal complex composition using Job's method of continuous variation and mole ratio method.
Unit III: Analysis of soil	Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators a. Determination of pH of soil samples. b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.
Unit IV: Analysis of water	Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods. a. Determination of pH, acidity and alkalinity of a water sample. b. Determination of dissolved oxygen (DO) of a water sample.
Unit V: Analysis of food products	Nutritional value of foods, idea about food processing and food preservations and adulteration. a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc. b. Analysis of preservatives and colouring matter

Unit VI: Chromatography	Definition, general introduction on principles of chromatography, paper chromatography, TLC etc. a. Paper chromatographic separation of mixture of metal ion ($Fe^{3+}$and Al^{3+}) b. To compare paint samples by TLC method

Practical:

1. Separation and identification of monosaccharides present in a given mixture (Glucose and Fructose) by paper chromatography. Report Rf Values.
2. Separation of organic compounds present in a given mixture by TLC method.
3. Determine the dissolve oxygen in water.

Course Outcomes (CO)

After completing the course, students will be able to:

1. Understand the basic principles and scope of analytical chemistry.
2. Apply quantitative analytical methods for estimation of metal ions.
3. Analyze soil and water samples for pH and other quality parameters.
4. Identify adulterants, preservatives, and colouring agents in food products.
5. Use chromatographic techniques for separation and analysis of chemical components.