# SYLLABUS

## CHEMICAL SCIENCES

**Note :**

**There are two Papers for each of the subject. Paper - I on Teaching and Research aptitude, Paper - II based on the Syllabus of concerned subjects. Details are furnished below:**

### PAPER - I

**Subject : General Paper on Teaching & Research Aptitude**

The Test is intended to assess the teaching / research aptitude of the candidate. They are supposed to possess and exhibit cognitive abilities like comprehension, analysis, evaluation, understanding the structure of arguments, evaluating and distinguishing deductive and inductive reasoning, weighing the evidence with special reference to analogical arguments and inductive generalization, evaluating, classification and definition, avoiding logical inconsistency arising out of failure to see logical relevance due to ambiguity and vagueness in language. The candidates are also supposed to have a general acquaintance with the nature of a concept, meaning and criteria of truth, and the source of knowledge.

There will be 50 questions for Paper- I. There is a prescribed syllabus for Paper-I.

1. The Test will be conducted in objective mode. The Test will consist of two Papers. All the two Papers will consists of only objective type questions and will be held on the day of Test in two separate sessions as under:

| Session | Paper | Number of Questions | Marks | Duration |
|---|---|---|---|---|
| First | I | 50 questions | 50×2=100 | 1 Hour |
| Second | II | 100 questions | 100×2=200 | 2 Hours |

2. Candidates who appear in two Papers and secure at least 40% aggregate marks for candidates belonging to General categories and atleast 35% aggregate marks for candidates belonging to reserved categories will be declared qualifies for Eligibility for Assistant Professor by following the reservation policy of the State Government.

3. The Syllabus of Paper–1 and paper – II will remain the same.

# SLET Commission, Assam
# (N.E. Region)

## Subject :Chemical Sciences Code No. : 31

## SYLLABUS

### INORGANIC CHEMISTRY

1. Chemical Periodicity.
2. Structure and bonding in homo-and-heteronuclear molecules, including shapes of molecules. (VSEPR Theory).
3. Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents.
4. Main group elements and their compounds: Allotropy, Synthesis, structure and bonding, industrial importance of the compounds.
5. Transition elements and coordination compounds: Structure, bonding theories spectral and magnetic properties , reaction mechanisms.
6. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.
7. Organometallic compounds: Synthesis , bonding and structure and reactivity. Organometallics in homogeneous catalysis.
8. Cages and metal clusters.
9. Analytical chemistry-separation, spectroscopic, electro- and thermoanalytical methods.
10. Bioinorganic chemistry: Photosystems, porphyrins, metalloenzymes, oxygen transport, electron-transfer reactions; nitrogen fixation, metal complexes in medicine.
11. Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques.

12. Nuclear chemistry: nuclear reactions, fission and fusion , radio-analytical techniques and activation analysis.

**PHYSICAL CHEMISTRY:**

1. Basic principles of quantum mechanics: Postulates; operator algebra; exactly-solvable systems; particle-in-a--box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta tunneling.
2. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications.
3. Atomic structure and spectroscopy; term symbols; many electron systems and antisymmetry principle.
4. Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated $\pi$– electron systems.
5. Chemical applications of groups theory; symmetry elements; point groups; character tables; selection rules.
6. Molecular spectroscopy : Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities- selection rules; basic principles of magnetic resonance.
7. Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase euilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.
8. Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities- calculations for model systems.

9. Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance-Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.
10. Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.
11. Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.
12. Solid state: Crystal structures; Bragg's law and applications; band structure of solids.
13. Polymer chemistry: Molar masses; kinetics of polymerization.
14. Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient.

**ORGANIC CHEMISTRY**

1. IUPAC nomenclature of organic molecules including region- and stereoisomers.
2. Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction.
3. Aromaticity: Benzenoid and non-benzenoid compounds-generation and reactions.
4. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzynes and nitrenes.
5. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways.

6. Common named reactions and rearrangements- applications in organic synthesis.
7. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, region and stereoselective transformations.
8. Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups.
9. Asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction-substrate, reagent and catalyst controlled reactions; determination of enantiomeric and diastereomeric excess; enantio-discrimination. Resolution-optical and kinetic.
10. Pericyclic reactions- electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.
11. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatom's (O,N,S).
12. Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids.
13. Structure determination of organic compounds by IR, UV-Vis, $^{1}H$&$^{13}C$ NMR and Mass spectroscopic techniques.

## INTERDISCIPLINARY TOPICS

1. Chemistry in nanoscience and technology .
2. Catalysis and green chemistry
3. Medicinal Chemistry
4. Supramolecular Chemistry
5. Environmental Chemistry.

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