# SABARMATI UNIVERSITY

# Research Entrance Aptitude Test (REAT)-(2025-26)

## Section B

## Chemistry syllabus

**Unit 1 Chemistry of Transition Elements**

Concept of crystal field theory (CFT), ligand field theory (LFT) and molecular orbital theory (MOT), splitting of d-orbitals in various stereochemistry, Jahn Teller effect : tetragonal distortion in octahedral complexes; spectrochemical series, nephelauxetic series, Electronic states and term symbols; term symbols for diatomic molecule, microstates; derivation of terms for closed subshell; derivation of terms for p 2 and d2 configurations. Correlation diagrams; Orgel diagram; Tanabe-Sugano diagram; selection rule; determination of Dq and electronic parameters; Interpretation of electronic spectra of 3d metal complexes.

**Unit 2 Organometallic compounds**

Introduction, classifications and general characteristics of organometallic compounds, Organometallic compounds of main group elements; Organometallic compounds of transition metals–σ-bonded and π-bonded organometallics, Catalytic processes involving transition metal organometallic compounds as homogeneous catalysts – hydrogenation, hydroformylation, oxidation, isomerization, dimerization and polymerization of alkenes and alkenes metathesis, Catalytic applications of main group organometallic compounds.

**Unit 3 Thermodynamics**

**(i) Chemical Thermodynamics :**

Introduction, revision of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Extensive and intensive properties, Gibbs-Duham equation and its application to study the partial molar quantities and their significance. Maxwell relations, thermodynamic equation of state, variation of chemical potential with temperature and pressure.

**(ii) Statistical Thermodynamics :**

Limitation of classical thermodynamics, statistical thermodynamics, Energy states and energy levels, macrostate and microstate, thermodynamic probability, the Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac distributions, Molecular partition function and their significance, thermodynamics properties in terms of partition function, Rotational, translational, vibrational and electronic partition function, the statistical

interpretation of entropy, Sackur-Tetrode equation, comparison of distribution function for indistiguishble particles.

**Unit 4 Electrochemistry**

Electrochemistry of solutions, Deye-Huckel theory of inter-ionic attraction, atmosphere, time of relaxation, relaxation and electro-phoretic effects, Dye-Huckel-Onsagar equation and its validity for dilute solution and at appreciable concentrated solutions. Activity coefficients : forms of activity coefficients and their interrelationship. Dye-Huckel limiting law for osmotic and activity coefficients of dilute electrolyte solutions and its application to concentrated solutions. Debye-Huckel-Bronsted equations, quantitative and qualitative verification of Dye- Huckel limiting law, Industrial applications of Electrochemistry.

**Unit 5 Stereochemistry**

Concept of Chirality, Chirality and Symmetry, Sawhorse, Newman and Fischer Projections, Interconversion of Projection formula, Elements of Chirality including Chiral centre, Chiral axis, Chiral plane and Helicity, CIP Nomenclature, Molecules with more than one Chiral centre, Total number of Stereoisomer in such molecules, Enantiomeric and Diastereomeric Relationship, Chirogenicity and Stereogenecity, Pseudochirality, Topicity and Prostereoisomerism, Determination of Topic relationship between Homomorphic ligands in Intact Molecules, Concept of stereoselective and stereospecific reactions, Optical Purity.

**Unit 6 Name Reaction Mechanism and their Application**

Molecular Rearrangement involving Non-classical Carbocation, Wagner-Meerwein and Related Rearrangements, Wolff, Curtius, Schmidt, Lossen, Beckmann, Benzil-Benzilic acid, Favorskii, Stevensen, Sommelet-Hauser Rearrangements, Vilsmayer-Heck Reaction, Mitsonobu Reaction, Suzuki Reaction, Stobbe condensation, Fries reaction, aldol and related reactions, Knoevenagel, Dieckman, Darzen, Claisen reaction.

Mechanisms and Orientation, E1, E1cb, E2 spectrum, Effects of Changes in Substrate, Base, Leaving Group and Medium on Reactivity, Hoffman and Saytzef eliminations, Bredt's Rule, Pyrolytic Eliminations- Cope and Chugaev eliminations; Addition reactions: Mechanisms, Orientation and Reactivity, Markonikoff and anti-Markonikoff additions, Reactions including Hydro-Halo, Hydro-Hydroxy, Hydro-Alkoxy, Dihydro, Dihydroxy, dihalo, ozonolysis.

**Unit 7 Organic Spectroscopy**

Principles and applications of UV–Visible spectroscopy including electronic transitions, chromophores, auxochromes, Woodward–Fieser rules and solvent effects; Infrared and Raman spectroscopy covering molecular vibrations, selection rules, characteristic functional group frequencies, hydrogen bonding and FT-IR techniques; NMR spectroscopy including fundamentals of $^{1}H$ and $^{13}C$ NMR, chemical shift, spin–spin coupling, multiplicity, DEPT, NOE and dynamic NMR; advanced 2D-NMR techniques such as COSY, HSQC, HMBC and NOESY for structure and stereochemical elucidation; Mass spectrometry involving ionization methods, fragmentation patterns, McLafferty rearrangement and HRMS; chiroptical methods (CD and ORD) for absolute configuration; hyphenated techniques (GC-MS, LC-MS) and integrated spectral interpretation for

structure elucidation of organic, natural product and pharmaceutical molecules. Give me very high difficult level 20 mcqs from this syllabus.

**Unit 8 Medicinal Chemistry**

Principles of drug discovery and development; physicochemical properties of drugs; pharmacokinetics and pharmacodynamics (ADME); drug–receptor interactions; structure–activity relationship (SAR), QSAR, bioisosterism and prodrugs; computer-aided drug design; medicinal chemistry of major therapeutic classes; drug metabolism, toxicity, regulatory affairs, and recent advances in medicinal chemistry.

**Unit 9 Environmental chemistry**

Chemical composition of the atmosphere, hydrosphere, and lithosphere; biogeochemical cycles; air, water, and soil pollution and their chemical processes; fate and transport of pollutants; environmental toxicology; analytical techniques for environmental monitoring; green chemistry and sustainable environmental management; climate change and emerging contaminants.

**Reference Books**


1. Fundamental Principles of Inorganic Chemistry, D. Banerjea, Sultan Chand & Sons,3rd ed. (1993).
2. Organometallic Chemistry, R.C. Mehrotra, Anirudh Singh, New Age International (P) Limited Publishers, 2nd ed. (2000).
3. Advanced Inorganic Chemistry, Cotton, Wilkinson, Murillo and Bochmann, Wiley & Sons, 6th ed. (2007).
4. Modern Electrochemistry – Vol. I & II, J. O. M. Bockris, A. K. N. Reddy, Plenum Press, Springer publication, 2nd ed. (2018).
5. An Introduction to Electrochemistry, S. Glasstone, Maurice Press, 1st ed. (2007).
6. Elements of Statistical Thermodynamics, M. C. Gupta, New Age International Limited 2nd ed. (1990).
7. Elements of Physical Chemistry, Peter Atkins, Julio De Paula, David Smith, Oxford University Press, 7th ed. (2017).
8. Organic Reactions, Stereochemistry and Mechanism: P.S. Kalsi (New Age.)
9. Modern Methods of Organic Synthesis: W. Carruthers (Cambridge)
10. Organic Chemistry: Clayden, Greeves and Warren (Oxford)
11. Graham L. Patrick – *An Introduction to Medicinal Chemistry*
12. Wilson and Gisvold – *Textbook of Organic Medicinal and Pharmaceutical Chemistry*
13. Stanley E. Manahan – *Environmental Chemistry*
14. Baird & Cann – *Environmental Chemistry*