SYLLABUS FOR COMPUTER BASED RECRUITMENT TEST (CBRT)
FOR THE POST OF ASSISTANT PROFESSORS IN GOVERNMENT COLLEGE
(CHEMISTRY(ORGANIC))
UNDER
DIRECTORATE OF HIGHER EDUCATION
(Advt No. 8 Year 2022)

I. General English including Grammar **- 05 marks**

II. General Knowledge, Current Affairs and Events of National and International Importance **- 10 marks**

III. Logical Reasoning and Analytical Ability **- 10 marks**

IV. Core: - 50 marks

Reaction Mechanism: Structure and Reactivity: Thermodynamic and kinetic requirements, Kinetic and Thermodynamic control, Hammonds postulate, Curtin-Hammett principle. Potential energy diagrams, transition states and intermediates. Effect of structure on reactivity: resonance and field effects, steric effect. Quantitative treatment: Hammett equation and linear free energy relationship, Substituent and reaction constants, Methods of determining reaction mechanism.
Aliphatic Nucleophilic Substitution: The SN2, SN1, mixed SN1 and SN2, SET mechanisms & SNi mechanism. The neighboring group mechanism, neighboring group participation by π and σ bonds, anchimeric assistance. Non-classical carbocations, phenonium ions, norbornyl system, common carbocation rearrangements-Wagner-Meerwein, Pinacol-Pinacolone and Demjanov ring expansion and ring contraction. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Esterification of carboxylic acid, transesterification, transetherification and preparation of inorganic esters. Phase-transfer catalysis, and ultrasound, ambident nucleophile,regioselectivity.

Nature of Bonding in Organic Molecules: Delocalized Chemical Bonding: Kinds of molecules with delocalized bond, cross- conjugation, resonance, pπ-dπ bonding (ylides). aromaticity: other systems containing aromatic sextet, Aromatic systems with electron number other than six. Huckel rule, other aromatic compounds, hyperconjugation.

Supramolecular chemistry: Introduction, Bonding other than covalent bond. Addition compounds, Crown ether complexes and Cryptands, Inclusion compounds, Cyclodextrins, Catenanes and Rotaxenes and their applications.
Stereochemistry: Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity in acylic and cyclohexane systems. Steric strain due to unavoidable crowding. Elements of symmetry: chirality, molecules with more than one chiral center, threo and erythro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, Optical activity due to chiral planes, Optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape. Asymmetric Synthesis: Principle and categories with specific examples of asymmetric synthesis including newer methods involving enzymatic and catalytic reactions, enantio and diastereoselective synthesis.
Common Organic Reactions and Their Mechanisms: Perkin condensation, Michael reaction, Robinson annulation, Diekmann reaction, Stobbe condensation, Mannich reaction, Knoevenagel condensation, Benzoin condensation, Witting reaction, Hydroboration, Hydrocarboxylation, Ester hydrolysis, Epoxidation.
Reagents in Organic Synthesis: Synthesis and applications of BF3, NBS, Diazomethane, Lead tetra-acetate, Osmium tetraoxide, Woodward Prevorst hydroxylation reagent, LiAlH4, Grignard reagent, organozinc and organolithium reagent.
Pericyclic Reaction: Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5 hexatrienes and allyl system. Classification of pericyclic reactions, Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions: conrotatory and disrotatory motions, 4n and 4n+2 and allyl systems. Cycloadditions- antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions andchelotropic reactions. Sigmatropic rearrangements-Suprafacial and Antarafacial shifts of H, sigmatropic shifts involving carbon moieties, Claisen, Cope and aza-Cope rearrangements, Ene reaction.

Nuclear Magnetic Resonance (NMR) Spectroscopy: General introduction, chemical shift, spinspin interaction, shielding mechanism, chemical shift values and correlation of protons present in different groups in organic compounds. chemical exchange, effect of deuteration, complex spinspin interaction between two, three, four and five nuclei, virtual coupling. Stereochemistry, hindered rotation, Karplus- relationship of coupling constant with dihedral angle. Simplification of complex spectra-nuclear magnetic double resonance, spin tickling, INDOR, contact shift reagents, solvent effects. Fourier transform technique, Nuclear Overhauser Effect (NOE). Introduction to resonance of other nuclei –F, P, Principle and introduction to C13 NMR, 2-D and 3-D NMR, Applications of NMR in organic chemistry.

Photochemistry – I: Introduction and Basic principles of photochemistry. Interaction of electromagnetic radiations with matter. Types of excitations, fate of excited molecules, quantum yield, transfer of excitation energy, actinometry. Photochemistry of alkenes: cis-trans isomerization, dimerization of alkenes, photochemistry of conjugated olefins, photo-oxidation of alkenes and polyenes Photochemistry of Aromatic compounds: Isomerization, addition and substitution, photo-reduction of aromatic hydrocarbons

Photochemistry – II: Photochemistry of Carbonyl compounds: Norrish Type I and II, Intermolecular and Intramolecular hydrogen abstraction, Paterno-Buchi reaction, α and βcleavage reactions of cyclic and acyclic carbonyl compounds, Formation of oxetane and cyclobutane from α, β unsaturated ketones, Photo-reduction of carbonyl compounds, Photorearrangement of enones, dienones, epoxyketones, Photo Fries rearrangement.

Oxidations: Introduction, Different oxidative process. Aromatiztion of six membered ring, dehydrogenation yielding C-C double bond, Oxidation of alcohols, Oxidation involving C-C double bond, Oxidative cleavage of ketones, aldehydes and alcohols, double bonds and aromatic rings, Ozonolysis, Oxidative decarboxylation, Bisdecarboxylation, Oxidation of methylene to carbonyl, Oxidation of olefines to aldehydes and ketones.

Reductions: Introduction, Different reductive processes. Reduction of carbonyl to methylene in aldehydes and ketones, Reduction of nitro compounds and oximes, Reductive coupling, bimolecular reduction of aldehydes or ketones to alkenes, metal hydride reduction, acyloin ester condensation, Cannizzaro reaction, Tishchenko reaction, Willgerodt reaction .

Note:

Duration for C.B.R.T : 90 Minutes

Maximum Marks for C.B.R.T : 75 Marks