SYLLABUS FOR COMPUTER BASED RECRUITMENT TEST (CBRT)
FOR THE POST OF ASSISTANT PROFESSORS IN GOVERNMENT COLLEGE
(CHEMISTRY(PHYSICAL))
UNDER
DIRECTORATE OF HIGHER EDUCATION
(Advt No. 12 Year 2024)

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

1. Spectroscopy

- Rotational and vibrational spectra of diatomic molecules (rigid and non-rigid).
- Moment of inertia, rotational spectra (diatomic and symmetric-top).
- Vibrational energy levels, anharmonic oscillator, overtones, hot bands.
- Diatomic vibrational–rotational spectra (P, Q, R branches).

2. Magnetic Resonance Spectroscopy (NMR & ESR)

- Theory of NMR: chemical shift, spin–spin coupling, relaxation phenomena.
- Fourier Transform NMR (FTNMR).
- ESR theory: fine and hyperfine structure.

3. Chemical Kinetics

- Complex reactions: reversible, consecutive, parallel, chain reactions.
- Rice–Herzfeld mechanism.
- Theories of reaction rates: collision theory, transition state theory.
- Steady-state approximation, Lindmann theory, thermodynamic formulation.

4. Thermodynamics

- Gibbs and Helmholtz free energy and their applications.
- Partial molar properties.
- Criteria of spontaneity and fugacity.
- Thermodynamics of ideal and non-ideal solutions.

5. Non-Equilibrium Thermodynamics

- Onsager reciprocity, phenomenological equations.
- Minimum entropy production principle.

6. Electrochemistry

- Ionic conduction and ion–solvent interaction.
- Debye–Hückel Limiting Law (and extended form).
- Ion association, solvation, and structure of solutions.

7. Quantum Chemistry

- Operators, eigenvalues/eigenfunctions, postulates of QM.
- Schrödinger equation, particle in a box, harmonic oscillator, rigid rotator.
- Hydrogen atom, orbital shapes (s, p, d), radial/angular plots.

8. Photochemistry

- Photophysical processes, Franck–Condon principle.
- Dissociation, pre-dissociation, excited state properties.

9. Diffraction Techniques

- X-ray diffraction: indexing, Bravais lattice, space group determination.
- Neutron diffraction basics and comparison with X-ray diffraction.

10. Superconductivity

- Basic phenomena: Meissner effect, energy gap, BCS theory (summary level).

Note:

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

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