भारतीय प्रौद्योगिकी संस्थान गोवा
गोवा अभियांत्रिकी महाविद्यालय परिसर, फार्मागुड़ी, फ़ोंडा – 403401, गोवा

Indian Institute of Technology Goa
Goa College of Engineering Campus, Farmagudi, Ponda – 403401, Goa

IITGoa/RECT/2026/01/TA(Che)/76 Date: 04-05-2026

NOTICE

Sub: Selection Procedure
Name of the Post: Technical Assistant (Chemistry) {PL 4; Group C}
Ref: Advt. No. IITGoa/RECT/2026/01 dated: 22.01.2026

1. **Selection Will Be Based on Performance in Selection Test.**

2. **Pattern of the Selection Test:**
   a. The Selection Test will be conducted in two stages, i.e. Selection Test I and Selection Test II. Candidates securing minimum qualifying marks as laid down by the selection committee in Selection Test I shall be shortlisted for Selection Test II. The final selection will be based on aggregate marks obtained from both the Selection Tests (I & II) with weightage of 40% in Selection Test I and 60% in Selection Test II.
   b. Selection Test I will be written test consisting of the following:
      i. 100 Marks: The test will include Short answer and Multiple-Choice Questions (MCQ). MCQ will be of 2 Mark each. 0.50 Negative Marks for every wrong answer.
      ii. Duration: 90 minutes
   c. Selection Test II: Trade Test (Laboratory exercise) of 100 marks.
      i. Duration: 120 minutes

3. **Syllabus: Selection Test I**

General aptitude: Basic Mathematical Concepts, Elementary Statistics & Probability Theory, Error Analysis, General Knowledge.

Atomic and Molecular Structure, Chemical Bonding and spectroscopy: Foundations and postulates of quantum mechanics, Uncertainty principle, particle in a box, Harmonic Oscillator, Atomic Orbitals, Pauli's Exclusion Principle; Hund's rule of maximum multiplicity, Chemical Bonding and shapes of molecules, Ionic bond: Packing of ions in crystals, radius ratio rule, Born-Land´e equation, Kapustinskii expression, Madelung constant, Fajan's rules; Covalent bond: Lewis structure, valence bond theory. Hybridization, molecular orbital theory, molecular orbital diagrams of diatomic and simple polyatomic molecules and ions; Multiple bonding (σ and π bond approach) and bond lengths; van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, instantaneous dipole- induced dipole interactions, hydrogen bonding; Effect of intermolecular forces on melting and boiling points, solubility energetics of dissolution process; Bond dipole, dipole moment, and molecular polarizabilities; VSEPR theory and shapes of molecules; ionic solids. Beer-Lambert's law, Laws of Photochemistry, Fundamental concepts of rotational, vibrational, electronic and magnetic resonance spectroscopy.

States of Matter: Kinetic molecular model of a gas, Maxwell-Boltzmann distribution: molecular velocities, law of equipartition of energy, molecular basis of heat capacities; Ideal gases, and deviations from ideal gas behaviour, van der Waals equation of state; critical state, law of corresponding states. Physical properties of Liquid, vapour pressure, surface tension and co-efficient of viscosity and their applications; effect of concentration of solutes on surface tension and viscosity; effect of temperature on viscosity of liquids. Unit Cells, Miller indices, crystal systems and Bravais Lattices, X-ray diffraction, Bragg's Law, Structure of NaCl, CsCl, and KCl, diamond, and graphite; Close packing in metals and metal compounds, semiconductors, insulators; Defects in crystals, lattice energy; isomorphism; heat capacity of solids. Born-Haber cycle, solvation energy, polarizing power and polarizability;

Thermodynamics and Equilibrium: Mathematical treatment, Reversible and irreversible processes; Laws of thermodynamics, thermochemistry, thermodynamic functions, such as enthalpy, entropy, free energy, etc., their properties and applications, Partial molar quantities, dependence of thermodynamic parameters on composition, Gibbs Duhem equation, Van't-Hoff equation, chemical potential and its applications. Law of mass action; Kp, Kc, Kx and Kn; Effect of temperature on K; Le-Chatelier principle; Ionic equilibria in solutions; pH and buffer solutions; Salt hydrolysis; Solubility and solubility product; Acid – base titration curves; Indicators; Dilute solutions; Raoult's and Henry's Laws and their applications; Colligative properties; Gibbs phase rule; Phase equilibria; single and two-component phase diagrams. Conductivity, equivalent and molar conductivity and their properties; Kohlrausch law; DebyeH¨uckel-Onsager equation; Ionic velocities, mobilities, transference numbers; Applications of conductance measurement; Quantitative aspects of Faraday's laws of electrolysis, applications of electrolysis in metallurgy and industry; Electromotive force of a cell, Nernst equation; Standard electrode potential, Electrochemical series; Concentration cells with and without transference; Applications of EMF measurements including potentiometric titrations.

Chemical Kinetics and surface properties: Order and molecularity of a reaction, differential and integrated form of rate expressions; Kinetics of opposing, parallel, and consecutive reactions; Steady state approximation in reaction mechanisms; Chain reactions; Uni-molecular reaction (Lindemann mechanism); Temperature dependence of reaction rates, Arrhenius equation; activation energy; Collision theory of reaction rates; Types of catalysts, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces;

Enzyme catalysis (Michaelis-Menten mechanism, Double reciprocal plot), Acid-base catalysis. Adsorption isotherms, surface area of adsorbents, Polymer weights, viscosity and surface tension.

Basic Concepts in Organic Chemistry and Stereochemistry: Electronic effects (resonance, inductive, hyperconjugation) and steric effects and its applications (acid/base property); optical isomerism in compounds with and without any stereocenters (allenes, biphenyls); conformation of acyclic systems (substituted ethane/n-propane/n-butane) and cyclic systems, substituted cyclohexanes, and polycyclic (cis and trans decalins) systems.

Organic Reaction Mechanism and Synthetic Applications: Chemistry of reactive intermediates (carbocations, carbanions, free radicals, carbenes, nitrenes, benzynes); nucleophilic substitution, elimination reactions and mechanisms; Rearrangement reaction, Reimer-Tiemann reaction, Michael reaction, Wittig reaction and McMurry reaction; Pinacolpinacolone, Favorskii, benzilic acid rearrangement, Baeyer-Villeger reaction; oxidation and reduction reactions in organic chemistry; Organometallic reagents in organic synthesis (Grignard, organolithium , organocopper and organozinc; Diels-Alder, electrocyclic and sigmatropic reactions; functional group inter-conversions and structural problems using chemical reactions.

Natural products and Heterocyclic chemistry: Chemistry of alkaloids, steroids, terpenes, carbohydrates, amino acids, peptides and nucleic acids. Monocyclic, bicyclic and tricyclic aromatic hydrocarbons, and monocyclic compounds with one hetero atom: synthesis, reactivity and properties, aromaticity; Electrophilic and nucleophilic aromatic substitution reactions.

Periodic Table and properties: Periodic classification of elements, Aufbau's principle, periodicity; Variations of orbital energy, effective nuclear charge, atomic, covalent, and ionic radii, ionization enthalpy, electron gain enthalpy, and electronegativity with atomic number, electronic configuration of diatomic molecules. Radioactivity, nuclear reactions, applications of isotopes;

Extractions of Metals: General methods of isolation and purification of elements; Principles and applications of Ellingham diagram.

Main group and transition metals: s and p block chemistry: Reactions of alkali and alkaline earth
metals with oxygen, hydrogen and water; Alkali and alkaline earth metals in liquid ammonia; Gradation in properties of main group element in a group; Inert pair effect; Synthesis, structure and properties of diborane, ammonia, silane, phosphine and hydrogen sulphide; Allotropes of carbon; Oxides of nitrogen, phosphorus and sulphur; Oxoacids of phosphorus, sulphur and chlorine; Halides of silicon and phosphorus; Synthesis and properties of borazine, silicone and phosphazene; Synthesis and reactions of xenon fluorides.

d-block chemistry; oxide, hydroxide and salts of first row metals; coordination complexes: structure, isomerism, reaction mechanism and electronic spectra; VB, MO and crystal field theoretical approaches for structure, color and magnetic properties of metal complexes; Organometallic compounds with metal-ligand single and multiple bonds (such as metal carbonyls, metal nitrosyls and metallocenes); Homogenous catalysis involving Wilkinson's catalyst.

Bio-inorganic chemistry: Essentials and trace elements of life; basic reactions in he biological systems and the role of metal ions, especially F e2+, and Zn2+; structure and function of myoglobin, hemoglobin and carbonic anhydrase.

Analytical Chemistry: Principles of qualitative and quantitative analysis; Acid-base, oxidation- reduction and complexometric titrations using EDTA; Precipitation reactions; Use and types of indicators; Use of organic reagents in inorganic analysis; Qualitative analysis of ions in mixture of salts, Basic principles; instrumentations and simple applications of conductometry, potentiometry and UV-vis spectrophotometry, polarimetry, colourimetry, calorimetry, analyses of water, air and soil samples.

4. Syllabus: Selection Test II

- The qualified candidates from selection test I will be required to perform a given standard experiment of undergraduate level and give demonstration for a given instrument or experiment.

NOTE: SYLLABUS MENTIONED ABOVE IS ONLY INDICATIVE AND NOT EXHAUSTIVE

5. Date and Venue:

- **Date of Selection Test:** 12.06.2026 (Friday) from 10:00 AM onwards
- **Venue:** IIT Goa Campus

Sd/-
Registrar