



राष्ट्रीय प्रौद्योगिकी संस्थान श्रीनगर
NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR
(An autonomous Institute of National Importance under the aegis of Ministry of Education, Govt. of India)
 हजरतबल, श्रीनगर, जम्मू-कश्मीर, 190006, भारत
 Hazratbal, Srinagar Jammu and Kashmir, 190006, INDIA

SYLLABUS FOR TECHNICAL ASSISTANT

(Department of Physics, Department of Chemistry, Department of Mathematics and
 Department of Humanities Social Sciences & Management)

PHYSICS (20 Marks)

- 1. Mechanics:** Newton Laws, Linear momentum, Angular momentum, Torque, Work and energy, motion of a particle under central forces, Rotation with a fixed axis, Components of torque and angular momentum.
- 2. Electricity and Magnetism:** Coulomb's Law, Gauss's Theorem, Potential and field due to an arbitrary charge, long charge wire and electric dipole, Bio-Saverts law, Maxwell's equations, Magnetic flux.
- 3. Optics:** Classification of interference, Young's experiment, Newton's rings, Michelson's Morley experiment, Types of diffraction, wave front, Fraunhofer diffraction, Rayleigh criterion of resolution,
- 4. EM Waves:** Equation of continuity, Scalar and vector potential, Displacement current, Maxwell's equation in differential form, Velocity of EM wave in free space and isotropic dielectric medium, Transverse nature of plane EM waves, pointing vector.
- 5. Waves And Vibrations:** Simple Harmonic Oscillations (SHM), Superposition of SHM, Natural, damped and forced oscillations, resonance, sharpness of resonance, Superposition of waves, beats
- 6. Quantum Mechanics:** Photoelectric Effect, Compton effect, Wave-particle duality, de-Broglie matter waves, Heisenberg's Uncertainty principle, The principle of superposition of waves, Phase and Group Velocity,
- 7. Thermodynamics and Statistical Physics:** Laws of thermodynamics; macrostates and microstates; phase space; ensembles; Zeroth law, First and Second law of thermodynamics, Carnot cycle, Physical concept of entropy, Black-body radiation.
- 8. Semiconductors:** Distinction between metals, semiconductors and insulators based on band theory, Intrinsic semiconductors and extrinsic semiconductors, concept of holes, effective mass, Formation of P-N junction, depletion region, Biased P-N junction,
- 9. Solid State Physics:** Elements of crystallography; diffraction methods for structure determination; bonding in solids; lattice vibrations and thermal properties of solids; free electron theory; band theory of solids:
- 10. Nuclear and Particle Physics:** Laws of radioactive decay, half-life, mean life, decay constant, Binding energy of nucleus, binding energy curve and stability; radioisotopes and their uses, nuclear transmutation, fission and fusion, nuclear reactor.

CHEMISTRY (20 Marks)

Section A : Physical Chemistry (07 Marks)

Chemical Kinetics

Determination of order of reaction by differential, integration, half life period and isolation methods. Techniques for kinetic investigation: Conductometry, Potentiometry, Polarimetry and Spectrophotometry. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Theories of chemical kinetics: Simple Collision theory – Basic approximations, evaluation of rate constant for atomic reactions, extension to molecular reactions and limitations. Photochemical decomposition of hydrogen iodide. Photochemical combination of Hydrogen-chlorine and hydrogen-bromine reactions.

Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry. Lambert-Beer law, Grothus-Draper law, Stark-Einstein law, Jablonski diagram -



राष्ट्रीय प्रौद्योगिकी संस्थान श्रीनगर
NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR
(An autonomous Institute of National Importance under the aegis of Ministry of Education, Govt. of India)

हजरतबल, श्रीनगर, जम्मू-कश्मीर, 190006, भारत
Hazratbal, Srinagar Jammu and Kashmir, 190006, INDIA

fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing) quantum yield, photosensitized reactions.

Electrochemistry

Migration of ions and Kohlrausch law, Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf's method and moving boundary method. Application of conductivity measurements: determination of degree of dissociation and dissociation constants of acids; determination of solubility product of a sparingly soluble salt, conductometric titrations.

Section B : Inorganic Chemistry (07 Marks)

Chemical Bonding

Valence bond theory: Directional Characteristics of Covalent bond; types of Hybridization and Shapes of simple molecules and ions. Limitations of VB theory.

Molecular Orbital Theory: LCAO, Energy level diagram of homo- & heteronuclear diatomic molecules like N₂, O₂, F₂, CO, NO and HCl. Multicentre bonding in electron deficient molecules; Bond strength and Bond energy. Percent ionic character from dipole moment and electronegativity difference. Weak interactions: Hydrogen bonding (concept, types; effect on properties) and Vander Waal forces.

Bioinorganic Chemistry

The natural selection of the elements: Abundance in the living systems and the distribution of elements essential for life in the periodic table. Biochemical role of Li, Na, K, Ca, Mg, Fe and halogens in living systems. Harmful effects of excess of metals on human body.

Qualitative & Quantitative Analysis

Underlying principles- Common-ion effect, Solubility product, Relation between Solubility and Solubility product. Types of Qualitative Analysis: - Macro, Semi micro; Micro; Ultra micro Analyses. Analysis of Inorganic Mixtures; - Group reagents, Selective precipitation of cations; Precipitation of Sulphides and metal hydroxides. Effect of acids, temperature and solvent upon the Solubility of a precipitate. Salt effect, Reactions involved in Separation and identification of Cations and anions.

Gravimetry: Introduction, Preparation of Solution and Precipitation methods. Physical properties of precipitates: Appearance, particle size and purity. Fractional precipitation. Colloidal State: Super-saturation; Precipitate formation, Co-precipitation and post - precipitation. Digestion, Washing, Ignition, and Gravimetric calculations.

Titrimetry: Types of titrations. Preparation of standard solutions; primary and secondary standards, Indicators: Types, Selection, and Preparation of indicator solutions.

Section C : Organic Chemistry (06 Marks)

Fundamentals of Organic Chemistry

Hybridization, Inductive, Electrometric, Resonance and Hyperconjugative effects. Requirements of aromaticity, Huckel's rule and its significance. Carbocations, Carbanions and Free radicals (Structure and stability) Carbenes, Benzynes and Nitrenes. Methods for determination of reaction mechanism.

Stereochemistry: Concept of stereo isomerism: elements of symmetry, molecular chirality, enantiomers and diastereomers, Inversion, retention and racemisation. Sequence rules. R,S-System of nomenclature. Geometrical isomers, E, Z-system of nomenclature. Conformations of n-butane, ethylene glycol and 1,2-dibromoethane, cyclohexane and its monosubstituted derivative, Axial and equatorial bonds.

Hydrocarbons and their Halogen Derivatives

Methods of formation of Alkenes, Saytzeff rule, Hoffman rule. Electrophilic and free radical additions. Markownikov's rule, Anti Markownikov's addition of HBr, hydroboration, ozonolysis. 1,2



राष्ट्रीय प्रौद्योगिकी संस्थान श्रीनगर
NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR
(An autonomous Institute of National Importance under the aegis of Ministry of Education, Govt. of India)

हजरतबल, श्रीनगर, जम्मू-कश्मीर, 190006, भारत
Hazratbal, Srinagar Jammu and Kashmir, 190006, INDIA

and 1,4 Addition in conjugated dienes. Diel's Alder reaction. Acidity of alkynes, Mechanism of electrophilic and nucleophilic addition reactions of Alkynes. Mechanism of nucleophilic substitution reactions of alkyl and benzyl halides: SN1, SN2 and SNi reactions. Aromatic Electrophilic substitutions: General pattern of the mechanism of nitration, halogenation Sulphonation and Friedal Craft's reaction. Activating and deactivating substituents, orientation and ortho/para ratio. Birch reduction. Addition - Elimination and Elimination Addition mechanisms of nucleophilic aromatic substitution reactions

MATHEMATICS (20 Marks)

Limit and continuity of a function of single variable, Types of discontinuities, Differentiability, Rolle's theorem, Mean value theorems, Maxima and minima (single variable functions), Indeterminate forms. Successive differentiation, Leibnitz theorem, Asymptotes, Tangents & normals (polar coordinates only), Curvature (Cartesian and polar coordinates), Double points (cusp, node, conjugate point), Partial derivatives, Euler's theorem for homogeneous functions. Order and Degree of a differential equation, Variable separable method, Linear differential equation of first order, Exact differential equations, Integrating factors, Reducible to exact differential equations, Linear differential equations of second and higher order with constant coefficients, Symbolic operators. Finite and infinite sets, examples of countable and uncountable sets, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals, concept of limit points. Sequences, Real sequence, bounded sequence, Cauchy convergence criterion of sequences, Infinite series, Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test. Definition and examples of groups, examples of abelian and non-abelian groups, the multiplication modulo n. Cyclic groups from number systems, complex roots of unity, isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle and (iv) a square, the permutation group Sym (n), groups of quaternions. Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, index of subgroup, Lagrange's theorem, order of an element. Types and properties of matrices, Inverse of a square matrix, matrix polynomials, characteristic equation, Cayley-Hamilton Theorem, Eigen values and eigen vectors of matrices and their determination, rank of a matrix, invariance of rank matrix under elementary transformations. Reduction of matrix to normal form, elementary matrices. Linear dependence and linear independence of vectors. Vector spaces, examples, subspaces, Basis and Dimension. Descarte's rule of signs positive and negative rule, relation between the roots and the coefficients of equations. Symmetric functions, applications symmetric function of the roots, transformation of equations, algebraic solutions of the cubic biquadratic, properties of the derived functions.

ENGLISH (20 Marks)

Grammar: Articles, Tenses, Narration, Voice and Prepositions, Punctuation

Vocabulary Building: Idioms and Phrases, Homonyms, Homophones and Homographs

Listening for Specific Purposes: Listening, Types of Listening—Active and Passive Listening

Non-Verbal Communication: Kinesics and Proxemics, Gestures, Expressions and Body Language

Reading For Information: Reading—Various Types Of Reading; Reading Comprehension, SQ3R Comprehension Method and Practice



राष्ट्रीय प्रौद्योगिकी संस्थान श्रीनगर
NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR
(An autonomous Institute of National Importance under the aegis of Ministry of
Education, Govt. of India)
हजरतबल, श्रीनगर, जम्मू-कश्मीर, 190006, भारत
Hazratbal, Srinagar Jammu and Kashmir, 190006, INDIA

Phonetics: An Overview of the Sound System in English: Vowels and Consonants, Pronunciation, Syllable Structure and Syllable Break-Up, Word Stress, Sentence Stress

Writing Skills: Sentence structure, Phrases and Clauses, Précis Writing, Note Making, Letter Writing Skills—Formal and Informal, Memo and email Writing Skills

COMPUTER EDUCATION (10 Marks)

Fundamental Of Computers: Computer Components, Computer Memory, Familiarity with Various Operating Systems and Platforms.

System Maintenance and Troubleshooting: Installation of Software and Hardware, Upgrades and Repairs as Needed, Oversee Digital Security, Maintenance of Systems, Troubleshoot Problems with the System, Analyze and Monitor Server Security.

Microsoft Office: Creating, Editing and Printing Text Documents, MS Excel, Create Dynamic Slide Presentations with Animation, Images, Narration Etc. using MS PowerPoint.