भारतीय विज्ञान शिक्षा एवं अनुसंधान संस्थान तिरुपति

INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH TIRUPATI

(An Autonomous Institution of National Importance under Ministry of Education, Govt. of India)

Ref.: Advt. No. 24/2025 Dated 06.02.2026

सूचना / NOTICE

Scheme of Selection, Pattern of Written examination and Syllabus for Non-Teaching Positions on Direct Recruitment

Scheme of Selection

1. For the Post Code 001 – 003, the written examination shall be only of qualifying in nature. The candidates who are shortlisted in written test and who fulfill all the eligibility conditions of the post shall be called for the interview. The final selection will be based on performance in the Personal Interview only.
2. For the Post Code 004 – 014, the merit list will be prepared on the basis of the performance of candidates in Written Examination only. Merit list shall be drawn on the basis of marks obtained by the candidates in written examination only. Skill test is mandatory but qualifying in nature. In the event of a tie, Candidates with earlier date of birth will be placed higher in the merit list.
3. The ratio of 1:5 (5 candidates against one vacancy) shall be provisionally maintained for shortlisting the candidates to appear in Phase II. This number may decrease if the total number of candidates appeared in the written test are less than 5 in respective category. Also, the number of candidates may increase if there is a tie in the marks secured by the candidates in the written examination. The Institute may anytime increase or decrease the ratio for shortlisting the candidate for appearing in interview/Skill Test.
4. The decision of the Institute regarding conduct of Examination, Skill Test, Interview, verification of documents and selection would be final and binding on all the applicants. No representation / correspondence will be entertained in this regard.

Pattern of written examination

1. The written examination will be MCQ based exam with 100 Multiple Choice Questions and will be of 90 minutes duration.
2. Each question will have 4 options out of which only one will be the correct answer.
3. The candidates will be awarded +1 mark for each correct answer.
4. For each incorrect answer, 0.5 marks will be deducted.
5. If a question is left blank/unanswered, there will be no penalty for that answer.
6. If any candidate encircles more than one answer, it will be treated as a wrong answer. Even if one of the given answers happens to be correct, it will be treated as a wrong answer and there will be penalty of 0.5 marks deduction.

Post Code 001 - Assistant Executive Engineer (Civil)

Phase - I: Written Examination

Syllabus

1. Building Materials, Solid Mechanics
2. Structural Analysis
3. Design of Steel Structures
4. Design of Concrete & Masonry Structures
5. Construction Practice, Planning and Management
6. Flow of Fluids
7. Hydraulic Machines and Hydro Power
8. Hydrology and Water Resources Engineering
9. Environmental Engineering
10. Geotechnical Engineering and Foundation Engineering
11. Surveying and Geology, Transportation Engineering

Phase - II: Interview

Post Code 002 - Medical Officer

Phase - I: Written Examination

Syllabus

1. General Medicine including Cardiology
2. Neurology
3. Dermatology and Psychiatry
4. Surgery including E.N.T Ophthalmology
5. Traumatology and Orthopedics
6. Paediatrics
7. Gynecology and Obstetrics
8. Preventive, Social and Community Medicine

Phase - II: Interview

Post Code 003 - Assistant Registrar

Phase - I: Written Examination

Syllabus

1. **General:** NITSER Act and Statutes, Office Procedure, RTI Act, POSH Act, CEI Act, All latest GoI orders in day to day use by the Institute, Grants/Projects Management, NEP 2020.
2. **Academics:** Grade Point System, Academic Credit System, Scholarships and IISER Academic Programmes.
3. **Administration:** FR & SR, LTC Rules, Leave Rules, Conduct Rules, CCS CCA Rules, TA/DA Rules, Medical Attendance Rules, Disciplinary & Vigilance, Reservation and Concessions for SC/ST/OBS/EWS/PwBD etc, Promotion, Pay Fixation, Seniority, Foreign Service, Deputation, Labour Laws, CCS (Pension) Rules, New Pension Scheme.
4. **Financial Administration:** GFR, Income Tax Rules, Receipt & Payment Rules, Budget, GST Rules, Commercial Accounting, Audit Procedures, Role and Functions of CAG, etc., Accounting of Grant-in-Aid Institutes, Financial Statements for Central Autonomous Bodies and Higher Educational Institutions.
5. **Procurement:** Procurement of Goods and Services, GeM Rules and Procedures, Central Public Procurement Portal, Tendering, Procuring, etc., Contract Management, Inventory Management, Procurement Manuals, Import of Goods and Make in India Policies.

Phase - II: Interview

Post Code 004 - Nurse

Phase - I: Written Examination

Syllabus

1. Nursing Foundation
2. Medical Surgical Nursing (including Pathology and Pharmacology, Nursing Education (including e-technology)
3. Paediatric Nursing
4. Mental Health Nursing
5. Nursing Management
6. Nursing Research and Statistics
7. Obstetrics and Gynaecological Nursing
8. Community Health Nursing
9. Anatomy
10. Physiology
11. Psychology
12. Sociology
13. Nutrition and Dietetics
14. Microbiology
15. Biochemistry

Phase-II: Skill Test

The skill test is intended to evaluate both theoretical understanding and practical competence essential for safe and effective nursing care. The skill test components are as follows:

1. Clinical knowledge and practical skills
2. Infection control and patient safety
3. Documentation and record keeping
4. Equipment handling

Post Code 005 - Private Secretary

Phase - I: Written Examination

Syllabus for Part-I (80 Questions)

NITSER Act, FR & SR, Statutes, RTI Act, Central Secretariat Manual of Office Procedure, PoSH Act, Conduct Rules, Email Etiquettes, GFR, Noting & Drafting, Leave Rules, CCA Rules, Pay Rules, CCS(MA) Rules, CGHS, Basic Account Procedures, Gem.

Part-II (20 Questions)

1. General Intelligence and Reasoning
2. General Awareness
3. Quantitative Aptitude
4. General English

Phase - II: Skill Test

The Computer based test is intended to assess candidates' hands-on skills in commonly used software and basic office operations, including MS Office (Word, Excel, PowerPoint), Email & Internet usage, Typing Test (A typing speed of 60 w.p.m. in English on Computer) and related tasks.

Post Code 006 - Superintendent

Phase - I: Written Examination

Syllabus for Part-I (80 Questions)

General: NITSER Act and Statutes, Office Procedure, RTI Act, POSH Act, CEI Act, all latest GoI orders in day to day use by the Institute, Grants/Projects Management, NEP 2020.

1. **Academics:** Grade Point System, Academic Credit System, Scholarships and IISER Academic Programmes.
2. **Administration:** FR & SR, LTC Rules, Leave Rules, Conduct Rules, CCS CCA Rules, TA/DA Rules, Medical Attendance Rules, Disciplinary & Vigilance, Reservation and Concessions for SC/ST/OBS/EWS/PwBD etc, Promotion, Pay Fixation, Seniority, Foreign Service, Deputation, Labour Laws, CCS (Pension) Rules, New Pension Scheme.
3. **Financial Administration:** GFR, Income Tax Rules, Receipt & Payment Rules, Budget, GST Rules, Commercial Accounting, Audit Procedures, Role and Functions of CAG, etc., Accounting of Grant-in-Aid Institutes, Financial Statements for Central Autonomous Bodies and Higher Educational Institutions.
4. **Procurement:** Procurement of Goods and Services, GeM Rules and Procedures, Central Public Procurement Portal, Tendering, Procuring, etc., Contract Management, Inventory Management, Procurement Manuals, Import of Goods and Make in India Policies.

Part-II (20 Questions)

1. General Intelligence and Reasoning,
2. General Awareness,
3. Quantitative Aptitude
4. General English

Phase - II: Skill Test

The Computer based test is intended to assess candidates' hands-on skills in commonly used software and basic office operations, including MS Office (Word, Excel, PowerPoint), Email & Internet usage, Typing Test, and related tasks.

Post Code 007 – Technical Assistant (IT)

Phase - I: Written Examination

Syllabus

Web Scripting languages like HTML 5, JavaScript, JQuery, Web Technologies, Hosting of Website on IIS, WAMP/ LAMP/ XAMP, Any RDBMS/ Database. Web application deployment on AWS / Azure Cloud, Programming language (s), Data Structures and Algorithms, Nodejs, Angular JS, NGNIX, Computer Fundamentals and Networking, Software Engineering, Linux Commands and Shell Scripting, SSL, Advance Excel and Basics of Computer/ Network Security, Google Workspace and Apps/Google Workspace Administration, Email Administration, Windows System Administration, Linux Administration, Network Security/Firewall Administration, Network Switches Configurations at Core, Distribution and Access levels, Configuration of servers like Active Directory, DHCP, DNS etc. Advance Excel Computer/ Network Security, Configuration of EPABX/SIP Server and IP Phones.

Phase-II: Skill Test

Configurations of the above and not limited to Switches, Servers, Audio and video equipment, Software Installation and trouble shooting, Linux and windows Administration, Setting up meetings and diagnosing Audio Video problems.

Post Code 008 – Technical Assistant (Biology)

Phase - I: Written Examination

Syllabus

1. Plant Biology

Evolution and diversity of land plants: bryophytes, ferns, gymnosperms, and angiosperms; Plant morphology, anatomy, and reproduction. Structure, distribution and functions of parenchyma, collenchyma, sclerenchyma, secretory ducts, laticiferous tubules, meristematic tissue, xylem and phloem. Structure, distribution and functions of epithelial tissue (squamous), connective tissue (fibrous). Different types of heterotrophic nutrition: holozoic, saprotrophic, parasitic and symbiotic. Feeding mechanisms: filter feeders, detritus feeders, biting and chewing, fluid feeders (sucking and piercing). Definition and types of growth, measurement of growth and patterns of growth. Growth and development in flowering plants. Plant growth regulators: phytohormones biological functions (auxin, gibberellin, cytokinin, abscisic acid and ethylene, photoperiodism. Plant reproduction, regeneration, metamorphosis and neoteny. Chloroplasts: structure, function and photophosphorylation. Photosynthesis and types of photosynthesis

2. Cell Biology

Structure and functions of the prokaryotic and eukaryotic cells. Evolutionary relationships and key characteristics of Invertebrates and Vertebrates. Cytoskeleton structure: microtubules and microfilaments. Transport mechanisms: simple diffusion, osmosis, facilitated diffusion, uniport, antiport, symport and bulk transport (ion channels, exocytosis, endocytosis, pinocytosis and phagocytosis). Structure and functions of cellular organelles (plant cells and animal cells). Cellular basis of tissues. Structure and functions of cells and tissues. Basic aspects of intercellular communication: autocrine, paracrine, endocrine and neuronal signaling. Chromosomes and higher order chromatin structure, functional domains within the nucleus. Cell cycle: cell division (mitosis and meiosis), and its regulation: checkpoints in the cell cycle. Types of microscopy, with principles and application.

3. Microbiology and lab instruments

Safety measures and rules of conduct to be followed in a microbiological laboratory. Cleaning of Glass wares and media Preparation; Bacterial culture techniques, Characteristics &identification of bacteria. Sterilization, disinfection and aseptic techniques - Definition of sterilization, disinfection, decontamination. Dry heat and moist heat. Principle and working of autoclave, pressure cooker, hot air oven. Maintenance of cultures- Stock cultures and subcultures. Handling and Care of Microbiological Instruments. Identification of bacteria using selective media. Instruments: Photometer, Water bath, Oven & Incubators, Water Distillation

plant and water deionizers, Colorimeter, pH meter, microscopes (monocular and binocular) and electrodes. Colorimetry - Lambert Beer's Law - Parts of photo colorimeter. Biological significance of water, weak interactions in aqueous systems, ionization of water, pH, pKa, biological buffer systems: body fluids and their principal buffers.

4. Biochemistry and Molecular biology

Basic Haematology and Clinical biochemistry – Sample collection - Blood, plasma, serum – definition. ABO blood group system. Monosaccharide, Disaccharides, Polysaccharides, mucopolysaccharides and glycoproteins. Sugar derivatives: amino sugars, sugar alcohol, sugar acids, deoxy-sugar and glycosides. Fatty acids: saturated, unsaturated and essential fatty acids; rancidity, saponification number, iodine number, acid number, fatty acids, amino acids. Peptide bond: planarity and dihedral angles, Ramachandran plot. Structural hierarchy of proteins: primary, secondary, super- secondary, tertiary and quaternary structures. Classification of proteins, properties: isoelectric point, zwitterions, and precipitation reactions. Globular and fibrous proteins: structure and functions of haemoglobin, collagen, elastin, and keratin. Chemistry of purine and pyrimidine, nucleosides and nucleotides. Types of DNA: structure and properties of A-, B- and Z-DNA. Denaturation, renaturation, Tm and hyperchromicity. Effect of acid and alkali on DNA and RNA. Types and functions of RNA: rRNA, mRNA, tRNA. Primary, secondary, and tertiary structures of tRNA. Restriction enzymes as tools in molecular biology.

5. Ecology-Evolution

Origin of life and early evolution; Evolution of cellular structures, functions and multicellularity; Natural selection, genetic drift, gene flow, and mutation; Mechanisms of speciation. Extinction events and their role in shaping biodiversity; Adaptive radiation and convergent evolution; Coevolution and evolutionary arms races; Human evolution. Concepts of species and hierarchical taxa, biological nomenclature, classical & quantitative. methods of taxonomy of plants, animals and microorganisms. Levels of organization- individual, population, community, ecosystem, biosphere; Abiotic and biotic ecological factors, Ecological adaptations. Population growth models- Exponential growth, logistic growth, density-dependent and density-independent factors, life tables, survivorship curves; Population dynamics, Metapopulations-Habitat fragmentation, connectivity, and extinction risk. Food webs, trophic levels, keystone species; Competition, predation, mutualism, parasitism; Primary and secondary succession, community stability. Energy flow in ecosystems- Primary production, trophic levels, energy pyramids; Biogeochemical cycles- Carbon, nitrogen, phosphorus, water cycles; Ecosystem services and human impacts. Biodiversity and its importance; Threats to biodiversity; IUCN categories of threat; Conservation genetics;

Population viability analysis (PVA); Ex-situ and in-situ conservation strategies; Community-based conservation and the role of indigenous knowledge; International and national conservation policies and legislation. Introduction to animal behaviour- Proximate and ultimate causes of behaviour; Foraging behaviour; Communication; Conflict and aggression; Migration, dispersal, and navigation; Social behaviour; Sexual selection and mating systems; Parental care.

Phase-II: Skill Test

DNA/RNA extraction, analysing by gel electrophoresis, analysis by spectroscopy and other methods, protein extraction from plants and tissues, analysis using gels. Simple cloning and restriction digestion, microscopic staining techniques, preparation and sterilisation of media, Characteristics &identification of bacteria. Solutions and Dilutions - Preparation of solution: Normal solution, Buffer solution, Percent solution, Molar solution. Diluting solutions: e.g. Preparation of 0.1N NaCl from 1N NaCl from 2N HCl. Preparing working standard from stock standard.

Laboratory instruments-calibration of volumetric apparatus. Principle, working, care & maintenance and calibration of weighing balance, autoclave, Centrifuges, Incubator, Hot air oven, Colorimeter, Spectrophotometer, Water distillation plant, pH meter. Anticoagulants-E.D.T.A, Dipotassium salts of EDTA Double oxalate, single oxalate, sodium citrate. Sodium Fluoride. Popular bacterial strains used in UG labs, E. Coli, Staphylococcus, viruses used for transduction. Plant pathogens such as bacteria, viruses and other organisms infecting plants. Cell culture methods including plant tissue culture and mammalian cell culture. Plotting a graph. Principles and applications: refraction, magnification, resolution, resolution limit and Ernst Abbe's equation. Laboratory record keeping, good laboratory practice, safety procedures in lab.

Post Code 009 - Junior Library Superintendent

Phase - I: Written Examination

Syllabus

1. Library Science Fundamentals

History and development of libraries, Library services and functions, Library Organization and Management, Library policies and procedures, Collection development and management, Preservation and conservation of library materials, Bibliography and reference services.

2. Information Retrieval and dissemination

Principles of information retrieval, Information retrieval systems and techniques, Information Retrieval and document delivery, Cataloging and classification, Search engines and web search, Indexing and abstracting, Bibliographic control, Information Sources and services, Print and electronic resources, Reference materials and services

3. Library trends and Technology

Library automation and integrated Library systems, Digitalization and digitization, Data Migration and data conservation, Electronic resources and services, Social media and libraries, Open source software for libraries, Library standard, MARC21, AACR2, RDA etc., Web based library services

4. Digital Libraries

Overview of Digital Libraries, Architecture of digital libraries, Digital libraries and repositories, Digital library software and tools, Digital library services and application, Metadata and indexing, Digital Transformation, Use of machine learning in libraries

5. Computers and Networking in libraries

Library networks (OCLC, INFLIBNET, DELNET, etc.), Operating system and file management, Computer networks, Networking concepts and technologies, Networking protocols, Internet and intranet technology for libraries, Web applications for libraries

6. Library Ethics and Issues

Ethics in library and information science, Intellectual property rights, Privacy and confidentiality, Professional development and continuing education

7. Information literacy

Overview of information literacy, Skills and competencies, Reference management tools

Phase-II - Syllabus for Skill Test (Total-50 Marks and 30 minutes duration):

Skill test will be of 30 minutes duration. Candidate will be required to perform activity asked by invigilator from below mentioned activities:

1. Cataloguing of books in Koha with all fields following the MARC standard and AACR rules, and save the record (analysis based on the accuracy and time frame).
2. OPAC searching and tracing of books from the shelves (precisely to the barcode no. in the book) (Time-bound)
3. Analyze the report from the Scopus Database, i.e. Institute, Author, Documents, etc. (analysis based on the accuracy and time frame).
4. Article searching from the subscribed resources (Time-bound)
5. Book Classification using DDC (analysis based on the accuracy and time frame).
6. Metadata Creation in D-space (Time-bound)

Post Code 010 - Junior Translator (Rajbhasha)

Phase - I: Written Examination

Syllabus / परीक्षा हेतु पाठ्यक्रम

1. संघ की राजभाषा नीती, संवैधानिक प्रावधान, राष्ट्रपति के आदेश – 1960, राजभाषा संकल्प - 1968, (राजभाषा अधिनियम नियम एवं वार्षिक राजभाषा कार्यक्रम)
2. राजभाषा हिंदी के संवर्धन हेतु कार्यरत सरकारी संस्थाएं, समितियां एवं योजनाएं
3. राष्ट्रभाषा और राजभाषा
4. हिंदी भाषा एवं साहित्य का विकास
5. हिंदी के प्रमुख साहित्यकार एवं कृतियां
6. हिंदी साहित्य की आधुनिक प्रवृत्तियाँ/ विमर्श
7. देवनागरी लिपि का इतिहास एवं विकास
8. हिंदी भाषा एवं साहित्य के विकास में देवनागरी लिपि एवं अनुवाद का योगदान
9. वाक्य संरचना, व्याकरण एवं वर्तनी
10. हिंदी से अंग्रेजी एवं अंग्रेजी से हिंदी में अनुवाद, वाक्यांश/परिभाषिक शब्दावली
11. हिंदी से संबंधित आई.टी. टूर्स
12. ई गवर्नेंस में हिंदी
13. हिंदी संबंधी सामान्य ज्ञान

Phase-II: Skill Test

A typing speed of 30 w.p.m. in Hindi on Computer.

Post Code 011 - Junior Office Assistant (MS)

Phase - I: Written Examination

Syllabus for Part-I (60 Questions)

1. **General:** NITSER Act and Statutes, Office Procedure, RTI Act, POSH Act, CEI Act, All latest GoI orders in day to day use by the Institute, Grants/Projects Management, NEP 2020.
2. **Academics:** Grade Point System, Academic Credit System, Scholarships and IISER Academic Programmes.
3. **Administration:** FR & SR, LTC Rules, Leave Rules, Conduct Rules, CCS CCA Rules, TA/DA Rules, Medical Attendance Rules, Disciplinary & Vigilance, Reservation and Concessions for SC/ST/OBS/EWS/PwBD etc, Promotion, Pay Fixation, Seniority, Foreign Service, Deputation, Labour Laws, CCS (Pension) Rules, New Pension Scheme.
4. **Financial Administration:** GFR, Income Tax Rules, Receipt & Payment Rules, Budget, GST Rules, Commercial Accounting, Audit Procedures, Role and Functions of CAG, etc., Accounting of Grant-in-Aid Institutes, Financial Statements for Central Autonomous Bodies and Higher Educational Institutions.
5. **Procurement:** Procurement of Goods and Services, GeM Rules and Procedures, Central Public Procurement Portal, Tendering, Procuring, etc., Contract Management, Inventory Management, Procurement Manuals, Import of Goods and Make in India Policies.

Part-II (40 Questions)

1. General Intelligence and Reasoning
2. General Awareness
3. Quantitative Aptitude
4. General English

Phase - II: Skill Test

The Computer based test is intended to assess candidates' hands-on skills in commonly used software and basic office operations, including MS Office (Word, Excel, PowerPoint), Email & Internet usage, Typing Test, and related tasks.

Post Code 012 – Lab Assistant (Biology)

Phase - I: Written Examination

Syllabus

1. Plant Biology

Plant morphology, anatomy, and reproduction. Different types of heterotrophic nutrition: holozoic, saprotrophic, parasitic and symbiotic. Definition and types of growth, measurement of growth and patterns of growth. Plant growth regulators: phytohormones biological functions (auxin, gibberellin, cytokinin, abscisic acid and ethylene, photoperiodism.

2. Cell Biology

Structure and functions of the prokaryotic and eukaryotic cells. Cytoskeleton structure: microtubules and microfilaments. Transport mechanisms: simple diffusion, osmosis, facilitated diffusion, uniport, antiport, symport and bulk transport (ion channels, exocytosis, endocytosis, pinocytosis and phagocytosis). Structure and functions of cellular organelles (plant cells and animal cells). Cellular basis of tissues. Structure and functions of cells and tissues. Types of microscopy, with principles and application.

3. Microbiology, Biochemistry and Molecular biology

Safety measures and rules of conduct to be followed in a microbiological laboratory. Cleaning of Glass wares and media Preparation; Bacterial culture techniques, Characteristics &identification of bacteria. Sterilization, disinfection and aseptic techniques - Definition of sterilization, disinfection, decontamination. Introduction to simple sugars, proteins and fatty acids. Nucleic acids-DNA and RNA in biology, DNA/RNA extraction and analysis.

Phase-II: Skill Test

Cleaning of Glass wares and media Preparation; Bacterial Culture techniques, Sterilization, preparation of simple buffers, disinfection and aseptic techniques - Definition of sterilization, disinfection, decontamination. Preparation & dispensing of Culture media. Enumeration of microbes by serial dilution method. Pure culture techniques- Spread plate, streak plate and pour plate technique. Staining Techniques – Gram's staining, Acid-fast staining, Endospore Staining and Capsule staining. Test for Motility of bacteria - Hanging drop technique Identification of bacteria by biochemical reactions. Laboratory record keeping, good laboratory practice, safety procedures in lab

Post Code 013 – Lab Assistant (Chemistry)

Phase - I: Written Examination

Syllabus

1. Chemical Analysis and Laboratory Safety Practices:

Undergraduate Level Experiments: Inorganic, Organic, Physical & Analytical Chemistry: Qualitative and quantitative analysis of Compounds, Volumetric Titrations, and Gravimetric Methods. Purification and Separation Techniques, including Chromatography. Basic Instrumentation: pH Meter, Conductivity Meter, Potentiometer, Polarimeter, UV–Vis and IR Spectroscopy.

Laboratory Rules, Standard Operating Procedures (SOPs), and Good Laboratory Practices (GLP). Chemical Hazards, MSDS, Fire and Electrical Safety, Safe Handling of Gas Cylinders and Cryogenic Materials, Chemical Waste Management and Laboratory Utilities and Equipment.

2. Physical Chemistry

Stoichiometry & Solutions: Laws of Chemical Combination, Mole Concept and Chemical Formula Calculations. Stoichiometry of Chemical Reactions and Solution Chemistry, Molarity, Molality, Normality, Mole Fraction, PPM and Percentage Concentrations. Dilution Effect and Quantitative Problem-Solving.

Structure of Atom: Atomic Models and Fundamentals of Quantum Mechanics. Schrödinger Wave Equation and Its Significance, Quantum Numbers, Atomic Orbitals and Shapes, Principles Governing Electronic Configuration and Atomic Stability.

States of Matter & Solid State: Gas Laws, Ideal and Real Gas Behavior, Kinetic Theory, and Van Der Waals Equation. Properties of Liquids - Vapor Pressure, Boiling Point, Viscosity, Surface Tension. Solid-State Chemistry - Types of Solids, Crystal Lattices, Unit Cells, Packing Efficiency, Defects, and Density Relationships.

Thermodynamics: Internal Energy, First Law of Thermodynamics, Enthalpy Changes, Hess's Law, Kirchhoff Equation, Entropy, Spontaneity, Second and Third Laws of Thermodynamics, Free Energy, Thermodynamic Equilibrium.

Electrochemistry & Redox Processes: Oxidation–Reduction Reactions and Electrochemical Applications. Electrode Potentials, Nernst Equation, Galvanic, Electrolytic, Concentration Cells, Electrical Conductance, Ionic Mobility, Batteries, Fuel Cells, Corrosion and Thermodynamic Relationships of Electrochemical Systems.

Chemical & Ionic Equilibria: Concept of Chemical Equilibrium. Equilibrium Constants, Le-Chatelier's Principle, Buffer Solutions, Solubility Product, Hydrolysis, Common Ion

Effect, Electrolytes, Ionic Product of Water, Henderson Equation, Dissociation Constants, and pH Calculations.

Chemical Kinetics: Rates of Chemical Reactions and Factors Affecting Reaction Rates. Rate Laws for Zero, First, and Second Order Reactions, Arrhenius Equation, Collision Theory, Transition State Theory, and Catalytic Kinetics Including Enzyme Catalysis, Half-Life Determination, and Pseudo-First-Order Reactions.

Surface & Colloid Chemistry: Adsorption and Adsorption Isotherms, Colloidal Systems and Classification, Electrokinetic Phenomena, Tyndall Effect, Brownian motion, Coagulation and Stability of Colloids and Applications.

3. Organic Chemistry

Organic Compounds & Reaction Mechanisms: Fundamentals of General Organic Chemistry Including Preparation, Properties, and Chemical Reactions of Hydrocarbons Such as Alkanes, Alkenes, Alkynes; Major Functional Groups Including Alcohols, Aldehydes, Ketones, Carboxylic Acids, Ethers, Esters, Phenols, Haloalkanes, Haloarenes, and Nitrogen-Containing Compounds. Concept of Reaction Intermediates, Mechanisms of Organic Reactions, Types of Organic Reactions.

Biomolecules: Structure, Classification and Biological Functions of Carbohydrates, Amino Acids, Proteins, Enzymes, Vitamins and Nucleic Acids including DNA and RNA.

Polymers: Classification of Polymers, Addition and Condensation Polymerization and Mechanisms, Copolymers and Types, Structure-Property Relationships, Molecular Weight and Distribution, Thermal and Mechanical Properties, Biodegradable and Conducting Polymers.

Advanced Organic Chemistry Topics: Stereochemistry Including Optical, Geometrical, and Conformational Isomerism, Heterocyclic Compounds and Properties, Aromatic Substitution Reactions, Pericyclic Reactions including Electrocyclic, Cycloaddition, and Sigmatropic Reactions and Fundamentals of Photochemistry and Photochemical Reactions.

4. Inorganic Chemistry

Classification & Periodicity: Periodic Table s, p, d, and d Block Elements, Diagonal Relationship, Inert Pair Effect, Periodic Trends in Atomic and Ionic Radii, Ionization Energy, Electron Affinity and Electronegativity.

d and f-Block Elements: Electronic Configuration and General Characteristics of Transition Elements, Lanthanides and Actinides, Common Compounds with Their

Properties and Reactions, Variable Oxidation States, Lanthanide Contraction, Complex Formation, Magnetic and Spectral Properties, Catalytic Behavior and Applications.

Chemical Bonding: Types of Chemical Bonds, Valence Bond Theory (VBT), Molecular Orbital (MO) Theory, VSEPR Theory, Hybridization, Resonance, Aromaticity and Lattice Energy.

Coordination Chemistry: Werner's Theory, Coordination Number, Ligands and Chelation, Isomerism in Coordination Complexes, Crystal Field Theory (CFT), Valence Bond Theory (VBT), Jahn-Teller Distortion, Magnetic and Spectral Properties, and Applications of Coordination Compounds.

Organometallic Chemistry: Bonding and Structure of Organometallic Compounds, Metal-Carbon Sigma and Pi Bonds, Stability Factors, Fundamental Reactivity Patterns, and Catalytic Applications.

5. Principles of Analytical Chemistry and Instrumental Analysis:

Principles of Analytical Measurements: Accuracy, Precision, Types of Errors, Mean, Standard Deviation (SD), Relative Standard Deviation (RSD), Quantification Limits, Calibration Curves, Sample Preparation Techniques, and Basic Qualitative and Quantitative Analysis.

UV-Visible Spectroscopy: Principle, Beer-Lambert Law, Instrumentation, Factors Affecting Absorbance and Applications.

IR Spectroscopy: Principle of Infrared Absorption and Theory, Molecular Vibrations Including Stretching and Bending Modes, Functional Group Identification, IR and Fingerprint Regions and Applications.

NMR Spectroscopy: Basic Principle, Instrumentation Overview, Chemical Shift, Spin–Spin Coupling, Basic Interpretation of ^{1}H and ^{13}C NMR Spectra.

Atomic Absorption Spectroscopy (AAS): Principle, Instrumentation, Flame and Graphite Furnace Methods, Interferences and Applications.

Gas Chromatography (GC): Principle, Instrumentation, Columns, Detectors, and Applications.

High Performance Liquid Chromatography (HPLC): Principle, Pumps, Columns, Detectors, Modes of Separation and Applications.

GC-MS and LC-MS: Principles of Hyphenated Techniques, Instrumentation and Interfaces, Common Ionization Methods and Molecular Identification Applications.

Electroanalytical Techniques: Basic Principles of Electrochemical Methods, Electrodes and Electrochemical Cells and Fundamentals of Cyclic Voltammetry (CV) with Applications.

Diffraction Techniques: X-Ray Diffraction (XRD) Principle and Bragg's Law.

Thermal & Surface Analysis: DSC and TGA Principles and Applications.

Microscopy & Surface Characterization: Basic Principles of SEM and Applications.

Phase-II: Skill Test

Skills pertaining to subject matter of the concerned post would be assessed through a skill test: The skill test shall be conducted in a manner which will elicit the ability of the candidate in handling various scientific experiments/tests, as the case may be in a typical laboratory setup of the concerned department.

This skill test is aimed to check the practical knowledge of the candidate in terms of various Do's and Don'ts in a laboratory related to various hazards, precautions etc.

Post Code 014 – Lab Assistant (Physics)

Phase - I: Written Examination

Syllabus

1. **General Physics:** Units and measurements, Dimensional analysis, Newton's laws of motion, Force and acceleration, Graphical representations, Circular motions, Torque and angular momentum, Moment of inertia, Work and Energy, Collisions and conservation laws, Friction, Potential energy and equilibrium, Simple harmonic motion, Forced vibration and resonance, Newton's law of Gravitation and motion under gravity, Elasticity and Young's modulus, Heat transfer and concept of temperature, Ideal gas, Thermal expansion.
2. **Mechanics, Waves and Oscillations:** Gradient, divergence and curl, physical significance and applications. Gauss, Stokes, Green's theorems. Theory of relativity, Inertial and non-inertial frames, Central force, Kepler's laws, Gyroscope and applications. Viscosity, Surface tension. Transverse and Longitudinal waves, SHM, principle of superposition, Standing waves, beats, Lissajous figures, Torsion pendulum, compound pendulum. Damped harmonic oscillator. Fourier theorem and applications, one dimensional transverse wave propagation, Modes of vibration of stretched string clamped at ends, overtones, and harmonics. Ultrasonics and applications.
3. **Optics and Spectroscopy:** Interference, Intensity distribution, Condition for maxima and minima, Phase and Path difference, Newton's rings, Michelson Interferometer. Diffraction, Fraunhofer diffraction, Single slit, Double slit, Fresnel Diffraction, Circular aperture and Narrow wire. Diffraction grating, Normal incidence, Oblique incidence. Dispersive power of a grating, Resolving power. Double refraction, Polarizer and Analyzer, Quarter and Half Wave plates, Plane, Elliptical and Circular polarization, Electro and Magneto Optic effects. EM spectrum, characterization, quantization of energy, Raman effect, Characteristics and applications. Lasers, Ruby laser, He-Ne laser, Fibre optics, single mode, multi-mode, applications.
4. **Thermodynamics and Radiation Physics:** Kinetic Theory of gases, Maxwell's distribution of molecular speeds, Mean free path. Work done in Isothermal and Adiabatic processes, Carnot's engine and its efficiency, Second law of thermodynamics. Entropy, physical significance, T-S diagram and its uses, Clausius-Clapeyron equation, Ratio of specific heats. Thermal conductivity, Lee's disc method. Blackbody radiation-Wien's law, Stefan's law, Newton's law of cooling from Stefan's

law, Solar constant, Pyrometers. Thermodynamic potentials and Maxwell relations, Joule effect; Joule-Thompson effect, Superconductors, applications.

5. **Electricity and Magnetism:** Basic laws of electrostatics, Electric field intensity due to various charge distributions, Electrical potential, Equipotential surfaces, Potential due to a point charge, Charged spherical shell and uniformly charged sphere. Electric dipole moment and Molecular polarizability- D,E and P relation, dielectric constant and susceptibility. Biot-Savart's law, solenoid, Lorentz force, Hall effect. Faraday's law, Lenz's law, Self and mutual inductance. Alternating current, LR, CR and LCR circuits, Q-factor. Displacement current, Maxwell's equations, Transverse nature of electromagnetic waves and Poynting theorem.
6. **Electronics:** Semiconductors, p-n junction diode, Zener diode, Bipolar junction transistor, Field effect transistor, Amplifiers, Oscillators, Operational amplifier, Integrated Circuits, Boolean algebra, Logic Gates, de Morgan's theorem.
7. **Modern Physics and Quantum Mechanics:** Photoelectric Effect, Millikan's experiment. Bohr, Sommerfield and Vector atom model, Pauli's exclusion principle, various quantum numbers, angular momentum and magnetic moment, LS and JJ coupling, Bohr magnetron, Stern and Gerlach experiments, Frank and Hertz's experiment. Spectral terms and notions - selection rules, fine structure of sodium D lines, alkali spectra and fine structure, spectrum of Helium, Zeeman effect, Larmor's theorem, Debye's explanation of normal Zeeman effect, Paschen-Back effect, Stark effect, ESR, Lande's g-factor, X-ray spectroscopy, Bragg's law, Moseley's law, Compton effect. Wave-particle duality, Superposition principle, Schrödinger equations, Heisenberg uncertainty principle, Hydrogen atom.

Condensed Matter Physics: Crystal lattice and types, Miller Indices. Point defects, Frenkel and Schottky defects,line defects, types of dislocation, surface defects-grain boundary, Effects of crystal imperfections. Dielectric materials, Polarization, Clausius-Mossoti relation. Dielectric breakdown, Properties of different types of insulating materials and magnetic materials.

Nuclear And Particle Physics: Nuclear size, charge, mass, mass defect and binding energy. Shell model-magic numbers and the liquid drop model. Natural radioactivity, law of disintegration, half life and mean life period, units of radioactivity-transient and secular equilibrium, radiocarbon dating, age of earth, alpha rays and G.M.Counters. Cyclotron and Betatron. Nuclear reactions. Classification of elementary particles and fundamental interactions. Elementary particle quantum numbers, quarks.

Phase-II: Skill Test (Hands-on Based)

B. Sc. Level experiments on the following topics:

- Mechanics
- Optics
- Electronics
- Modern Physics
- Basic Solid State Physics

Note:

1. The syllabus is indicative and not exhaustive. The syllabus should not be considered as the only source of information while preparing for the examination.
2. The Date, Time, Venue of examination, Skill Test & Interview will be communicated in due course of time. The candidates are requested to regularly check the Institute Website for all updates.