CSIR-CENTRAL BUILDING RESEARCH INSTITUTE
(Council of Scientific & Industrial Research)
(Website: www.cbri.res.in)

No. 76(2)2/2023-Per **Dated 25.01.2025**

Notice

In continuation to this office notifiction to advt. No. CSIR-CBRI 08/2023 of even No. dated 22.01.2025 and **advertisement No. CSIR- CBRI 8/2023,** all the candidates, who have screened in for calling for Trade Test for the posts of Technical Assistant are hereby informed that the syllabus for the trade test as well as Paper III of the written examination as per following details:-

Sr. No.	Post Code	Area	Annexure	Tentative date of trade test
1	TA20231	Civil Engg.	I	**15-16 Feb 2025**
2	TA20232	Architecture Engg.	II	**15-16 Feb 2025**
3	TA20233	Electrical Engg.	III	**15-16 Feb 2025**
4	TA20234	Electronics Engg	IV	**15-16 Feb 2025**
5	TA20235	Information Technology	V	**15-16 Feb 2025**
6	TA20236	Mechanical Engg.	VI	**15-16 Feb 2025**
7	TA20237	B.Sc. Chemistry	VII	**15-16 Feb 2025**
8	TA20238	B.Sc. Physics	VIII	**15-16 Feb 2025**
9	TA20239	B.Sc. Geology	IX	**15-16 Feb 2025**
10	TA202310	B.Lib.Sc.	X	**15-16 Feb 2025**

All the candidates are hereby informed to prepare themself for attending the trade test on the scheduled dates. the admit card mentioning exact date, time and venue of trade test will be intimated through registered e-mails or message on registered mobile no as the case may be separately.

Priya Singh
Section Officer (R&A)

ENCL-Annexure I to X

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ANNEXURE I

Syllabus for Trade Test/ Written Test(Paper-III)

Civil Engineering (Post Code: TA20231)

Sl. No.	Topic	Details
1.	Estimating, Costing and Valuation:	Estimate, glossary of technical terms, analysis of rates, methods and unit of measurement, Items of work – earthwork, Brick work (Modular & Traditional bricks), RCC work, Shuttering, Timber work, Painting, Flooring, Plastering. Boundary wall, Brick building, Water Tank, Septic tank, Bar bending schedule, Centre line method, Mid-section formula, Trapezodial formula, Simpson's rule. Cost estimate of Septic tank, flexible pavements, Tube well, isolates and combined footings, Steel Truss, Piles and pile-caps. Valuation – Value and cost, scrap value, salvage value, assessed value, sinking fund, depreciation and obsolescence, methods of valuation.
2.	Engineering and Building Drawing:	Scales, Lettering Dimensioning, Orthographic, Isometric, Sections, Common Symbols and conventions, Drawing of building components as Walls, Footing, Doors, Windows, Staircases.
3.	Environmental Engineering: -	(a) **Water Supply Engineering:** Sources of supply, design of intakes, estimation of demand, water quality standards, primary and secondary treatment, maintenance of treatment units, conveyance and distribution of treated water, rural water supply.
		(b) Waste water Engineering & Pollution control: Quantity, collection and conveyance and quality, disposal, design of sewer and sewerage systems, pumping, characteristics of sewage and its treatment, rural sanitation, sources and effects of air and noise pollution, monitoring, standards.
		(c) **Solid Waste Management:** Sources, classification, collection and disposal.
4.	Fundamentals of Hydraulics & Fluid mechanics:	Fluid properties, hydrostatics, measurements of flow, Bernoulli's theorem and its application, flow through pipes, flow in open channels, weirs, flumes, spillways, pumps and turbines. Water Methods of irrigations, Hydrology, Runoff, requirement for Crops, wells and tube wells, Cross draining works. Water logging river training works.
5.	Applied Mechanics,	Strength of material and structural Analysis Force System, equilibrium, friction, centroid, moment of inertia. Kinematics and Kinetics of rigid bodies, Simple stresses, normal stresses, Shear stresses in beams. Shear force and bending moment diagrams for determinate beams and frames.
6.	Surveying :	Principles of surveying, measurement of distance, chain surveying, working of prismatic compass, compass traversing, bearings, local attraction, plane table surveying, theodolite traversing, adjustment of theodolite, Levelling, Definition of terms used in levelling, contouring, curvature and refraction

		corrections, temporary and permanent adjustments of dumpy level, methods of contouring, uses of contour map, tachometric survey, curve setting, earth work calculation, advanced surveying equipment.
7.	**Building Construction & Materials:**	Properties of wet and hardened concrete, tests on concrete, factors affecting strength of concrete, water-cement ratio, aggregate- cement ratio, mix design, additives, design of form work, types of formwork. Stones, bricks, cements, lime, mortar, timber, plastic, concrete, steel, paints and varnishes. Principles of building planning and design, integrated approach, building byelaws, building services such as vertical transportation, water supply sanitation, thermal ventilation, lighting, acoustics, fire protection, electrical fittings. Foundations, stones, brick and block masonry, steel and reinforced cement concrete structures, floors, doors and windows, roofs, finishing works, water proofing.
8.	**Concrete Technology:**	Properties of concrete in fresh and hardened state water cement ratio, hydration process, Design mix of concrete. Laboratory and field tests on concrete Compaction finishing and curing of concrete, Basic knowledge of special concretes, Ready Mix concrete Fibre Reinforced concrete. Self-Compacting concrete, High strength Concrete, repair and maintenance of concrete structures etc.
9.	**Reinforced Cement Concrete and Steel Design: -**	Design using Limit State method for Beams, slabs, columns, staircases and footing for Strength and serviceability. Design of steel Beams tension members, compression members, built-up beams, plate girders roof trusses etc. Earthquake resistant design. Knowledge of related latest IS codes, IS 1893, IS456 IS800 IS13920 IS4326 etc.
10.	**Transportation Engineering:**	Highway Engineering – cross sectional elements, geometric design, types of pavements, pavement materials – aggregates and bitumen, different tests, Design of flexible and rigid pavements – Water Bound Macadam (WBM) and Wet Mix Macadam (WMM), Gravel Road, Bituminous construction, Rigid pavement joint, pavement maintenance, hill road, drainage and Highway maintenance.
11.	**Soil Mechanics:**	Origin of soil, phase diagram, Definitions-void ratio, porosity, degree of saturation, water content, specific gravity of soil grains, unit weights, density index and interrelationship of different parameters, Grain size distribution curves and their uses. Index properties of soils, Atterberg's limits, ISI soil classification and plasticity chart. Permeability of soil, coefficient of permeability, determination of coefficient of permeability, Unconfined and confined aquifers, effective stress, quick sand, consolidation of soils, Principles of consolidation, degree of consolidation, pre-consolidation pressure, normally consolidated soil, e-log p curve, computation of ultimate settlement. Shear strength of soils, direct shear test, Vane shear test, Triaxial test. Soil compaction,

		Laboratory compaction test, Maximum dry density and optimum moisture content, earth pressure theories, active and passive earth pressures, Bearing capacity of soils, plate load test, standard penetration test.
12.		Construction Planning management, CPM-PERT Bar chart, Planning, Organization, Labour Scheduling Control of Progress, safety, Inspection and Quality control, Repair and Maintenance of building works.

ANNEXURE II

Syllabus for Trade Test/ Written Test(Paper-III)
Architecture (Post Code : TA20232)

Sl. No.	Topic	Details
1.	Architectural Design	Principles of Visual perception & the grammar of visual language, Principles of composition and relationship between the human activities and study of anthropometrics, Circulation analysis, study of space for different human activities; Site planning: off- site & on-site parameters Volumetric study of built forms & Analysis of form Critical appraisal of both internal and external spaces; Basic and standard dimensions for all types of buildings, Passive and active solar architecture; Universal design parameters; Design for Person with disability, National Building Code norms
2.	Planning	Complex and Town and satellite planning,Transport and circulation analysis, hierarchy of access and pedestrian circulation, vehicular circulation and road systems, density, building bye laws. Inclusive development & Planning Theories.
3.	Landscape design	Components of landscape design, Principles of landscape design, Study of landscape design aspects, Site analysis and site planning, Hard and soft landscapes, Elements of urban landscape Energy efficient landscape, Recreational spaces Ecology and landscape design Garden types: Mughal gardens, Persian Gardens, English Garden, Japanese Garden, Healing Garden – design principles and symbolisms.
4.	History of Architecture	The study of noted buildings, Indus valley civilization, Development of the city of Mohenjodaro, Harappa and various other river valley civilizations. European architecture & aesthetic evolution, Study on architectural proportion of noted monuments. Temple architecture & Buddhist architecture in India, Islamic Architecture.
5.	Climatology	Influence of various factors at regional and local scales– Macro & micro climate. Climatic zones and sun path diagram, Study of parameters for human thermal comfort, comfort scales, elements of climate, Understanding the thermal environment and interpretation of architectural principles. Passive and low energy approaches to thermal comfort. Study of Vernacular architecture, The visual environment– study of day-lighting as a means of providing light within built spaces, "Green" Architecture– its elements. Bodies- GRIHA, LEED Climate study instruments.
6.	Modern & Post Modern Architecture	The Industrial revolution– Development of cities, evolution of buildings, Development of skyscrapers–the Chicago school; Development of architectural theories & philosophies.Works and philosophy of Architects like Le Corbusier, Mies van der Rohe, Frank Lloyd Wright, Alvar Alto, Walter Gropius, FLW,

		F.O.Gehry, Norman Foster, Richard Roger, Zaha Hadid; Development of vernacular architecture in India , Post Independence Architecture in India, The works of Modern Indian masters like Charles Correa, J.A. Stien, B.V. Doshi, Ananth Raje, Kanvinde, Laurie Baker, Brinda Somaya, Nari Gandhi, Raj Rewal etc.
7.	Building Construction	Building components and their pictorial representations; various types of arches, & brick masonry bonds, stone masonry bonds, different types of foundations, various types of roofs & slabs, plastering, pointing. Types of steel trusses, skylights; Carpentry and joinery details; Doors and Windows; Form-work for RCC; detailing of RCC elements, RCC Construction practices & its detailing; Framed structures, light partition. Materials of sound insulation, weather proofing, damp proofing; Structural glazing, various types of wall claddings, Specialized roofing systems like shell roof, folded plates, and space frames. Detailing of all types of Stair, Study of building Materials. Flooring and paving, Building hardware, Paints and varnishes, Additives and admixtures and Construction equipments.
8.	Structures	Fundamentals of structures for Buildings: Forces Systems & Equilibrium, Analysis of Structure: centre of gravity, shear force & bending moment, moment of inertia, stress and strain, theory of simple bending, Study of Geometric Properties of Structural Sections, Structural behavior of beams, deflections in beam, Design of axial loaded column and concentrated load beam sections.
9.	Energy, Ecology and Environment	Natural resources, environmental issues & conservation, environmental impact assessment, Energy conservation techniques– non conventional energy sources like, solar power– wind power– etc. Green building techniques and design principles.
10.	Building Services	Study of water Supply and sanitation systems; Study of fire fighting services. Sanitation: principles of sanitation and disposal of waste water, sewage treatment, septic tanks, etc.Storm water drainage system, recycling of water; Water treatment plant; & rain water harvesting. Air-conditioning & ventilation- Definition and classification, Vertical Transportation system-Concept, study of lifts and escalators. Electrical – Layout, selection & placing of fittings, quality of day light, illumination level, systems of wiring.
11.	Building Specification	Detailed specification in construction practice, detailed specification writing for various building materials and works. Specification for works designed for special situation like nonconventional use of conventional materials, etc.
12.	Computer Graphics	MS Office, Autocad, Revit, Photoshop, sketch-up, 3D perspectiv building orientation and shading, working drawings, presentatic drawings

(B)

ANNEXURE III

Syllabus for Trade Test/ Written Test(Paper-III)

Electrical Branch (Post Code: TA20233)

Sl. No.	Topic	Details
1.	Basic Concepts:	Concepts of resistance, inductance, capacitance and various factors affecting them, Concepts of current voltage, power, energy and their unit.
2.	Circuit Law:	Ohms Law, Simple Circuit solution and calculations using Ohms Law.
3.	Magnetic Circuits	Concepts of flux, mmf, reluctance, Different kinds of magnetic materials, inductance, inductance calculation in series and parallel.
4.	Electrostatics	Concepts of electric flux, emf, capacitors, values of capacitors, measurement of capacitance, capacitance calculation in series and parallel.
5.	AC Fundamentals	Instantaneous, peak, RMS and average values of alternating waves, Representation of sinusoidal wave form, simple series and parallel AC Circuits consisting of RL and C, Resonance, Tank Circuit, Poly Phase system - star and delta connection, 3 phase power, DC and sinusoidal response of R- Land R-C circuit.
6.	Measurement and measuring instruments	Measurement of power (single phase and 3 phase, both active and re-active) and energy, 2 wattmeter method of 3 phase power measurement, Measurement of frequency and phase angle, Ammeter and Voltmeter (both moving oil and moving iron type), extension of range wattmeter, Multimeters, Megger, Energy meter AC Bridges Use of CRO, Signal Generators, CT, PT and their uses Earth Fault detection.
7.	Electrical Machines	(a) DC Machine - Construction, Basic Principles of DC motors and generators, their characteristics, speed control and starting of DC Motors Methods of braking motor, losses and efficiency of DC Machines (b) single phase and 3 phase transformers-Construction, Principles of operation, equivalent circuit, voltage regulation, OC and SC Tests, Losses and efficiency, Effect of voltage, frequency and wave form on losses, Parallel operation of single phase/3 phase transformers, checking the polarity of windings of three face transformers, cooling of transformers, Auto transformers (c) 3 phase induction motors, rotating magnetic field, principles of operation, equivalent circuit, torque-speed characteristics, starting and speed control of 3 phase induction motors, Methods of braking, effect of voltage and frequency variation on torque speed characteristics, Fractional Kilowatt Motors and Single Phase Induction Motors: Characteristics and applications.
8.	Synchronous Machines	Generation of 3-phase emf armature reaction, Voltage regulation, basic knowledge of AC alternators, synchronizing, control of active and reactive power, Starting and applications of synchronous motors.
9.	Generation and Switch Gear & Protection	Different types of power station, Load factors, diversity factors, demand factors, cost of generation, inter-connection of power stations, Power factors improvement, various types of tariff. Types of faults, calculations of short circuit current for symmetrical faults Switchgears, types of circuit breakers, oil circuit breakers, air blast

		circuit breakers, SF6 & vacuum circuit breakers, rating of circuit breakers, Principle of arc extinction, HRC Fuses, Protection against earth leakage / over current etc. Buchholtz relay, Merz-Price system of protection of generators & transformers, protection of feeders and bus bars, Lightning arresters, Cable-Different type of cables, cable rating and derating factor.
10.	Transmission & Distribution	Transmission of Electrical Power, Mechanical Design of Transmission Line, HVDC Transmission, Power System Stability, PLC. Layout of Transmission system, Three phase and single phase transmission system, overhead and underground transmission system, HVAC and HVDC transmission system, comparison of conduction material, types of supports, types of insulators, selection of insulators, conductors, earth wire and their accessories. AC distribution and utilization: AC distribution, SCADA system energy tariff, cables, electric heating and welding, electric drives, illumination, layout of HT and LT distribution system, construction of HT & LT underground power cables, laying of cables, Estimation of LT & HT overhead distribution lines.
11.	Substation	Estimation, layout and brief idea of sub-station, grid sub-station 220/132 KV, outdoor power sub-stations, indoor & pole mounted sub- stations, 33/11 KV distribution sub-stations and 11 KV/440 volt distribution/pole mounted sub-stations. Design & types of single phase and three face transformers, primary and distribution transformers, open circuit and short circuit test, measurement of loses and voltage,, working principle of transformers.
12.	Non-Conventional Energy	Non-conventional energy source, solar energy engineering, wind energy engineering, ocean energy engineering, geothermal energy engineering, bio energy engineering, direct energy conversion systems, chemical energy sources.
13.	Environmental Engineering, Entrepreneurship	Ecology, factors causing pollution, effects of pollution on human health, air pollution and control act, water pollution and control act.
14.	Digital Electronics, Elements of Electronics and Devices	Semiconductors, electronic devices, transistor, transistor amplifier, feedback circuit and oscillator, special semiconducting devices, integrated circuits, number system logic gates, Boolean algebra, combinational logic, flip-flops, register and counters, data converter & memory devices, display construction.
15.	Utilization of Electrical Energy	Illumination, different type of light fittings, Electric heating, Electric welding, Electroplating, Electric drives and motors (three phase and single phase)
16.	Protective Device	Basic knowledge of earthing, Lightning conductor, surge protector And Isolation transformer.
17.	Installation commissioning and maintenance of electrical equipments	Maintenance concepts, types of maintenance, maintenance schedules, maintenance management, history cards and job cards, testing of electric equipments before commissioning, testing of industrial wiring, batteries and measurement of earth resistance

18.	Estimation and costing	Estimation of lighting scheme (domestic as well as industrial wiring), electric installation of machines and relevant IE rules, Earthing practices and IE Rules, load calculation, knowledge of Indian electricity rules, safety codes and requirements, causes and prevention of accidents, procedure on occurrence of accidents, first aid, artificial respiration, investigation and management of accidents, workmen's safety devices and periodical inspection of safety devices.

(4)

ANNEXURE IV

Syllabus for Trade Test/ Written Test(Paper-III)

Electronics Branch (Post Code – TA20234)

Sl. No.	Topic	Details
01	ELECTRONIC DEVICES AND ANALOG ELECTRONICS	Semiconductor Devices, Diodes and their applications, Types of Diodes, Rectifiers, Bipolar Junction Transistor (BJT), JFET, MOSFET and its applications, transistor amplifier Oscillators, Differential Amplifiers, Feedback Amplifiers, Operational Amplifier: applications & Configurations, Thyristor, SCR, Instrumentation amplifiers, Analog to digital and digital to analog converters
02	CIRCUIT THEORY AND NETWORKS	Electronic circuits, Network Theorems (AC and DC), Time Domain and Frequency Domain Analysis, Waveform generators (555 Timer), Single phase AC parallel circuit, three phase circuit
03	DIGITAL ELECTRONICS	Number Systems, Logic Gates, Combinational Logic Circuits, Boolean Algebra and Karnaugh maps, Encoders, Decoders, Multiplexers and De-multiplexers, Arithmetic Logic Operations and Circuits, Flip-Flops, Registers, Counters and Memories
04	MICROPROCESSORS & MICROCONTROLLERS	Microprocessor Introduction, 8-bit and 16-bit microprocessor, Architecture, Programming, I/O operations, Interfacing of Peripherals, Microcomputer systems, Microcontroller Introduction, Architecture, Instruction set, I/O port programming, Timers, Interrupts, Serial Communication using 8051 series microcontrollers. Interfacing of Peripherals and System Expansion.
05	ELECTRONIC MEASUREMENTS	Basics of Measurements and Bridges, Error types, Units and Standards, AC/ DC Bridges and types, Potentiometer and its Applications, Measuring Instruments, PMMC, MI, Electro Dynamo Type Instruments, Energy Meter, Electronic Instruments: Voltmeter, Multimeters, Q – Meter, Vector Impedance Meter, Oscilloscopes, Transducers: RTD, Thermocouple, Thermistor, LVDT, Strain Gauge, Piezoelectric Transducers.
06	DIGITAL SIGNAL PROCESSING	Discrete time signal and system, discrete Fourier transform and fast Fourier transform.
07	COMPUTER ARCHITECTURE	Computer architecture and basic computer organization and design, central processing unit, memory organization, input-output organization.

08	INDUSTRIAL AUTOMATION AND ROBOTICS	INDUSTRIAL AUTOMATION AND ROBOTICS: Introduction to Industrial automation and data acquisition, P-I-D Control, Basic components of a Robot, Introduction to Robot End Effectors, Types of End effectors.

(5)

ANNEXURE V

Syllabus for Trade Test/ Written Test(Paper-III)

Information Technology Branch (Post Code: TA20235)

IT

Sl. No.	Topic	Details
1	**COMPUTER ARCHITECTURE & ORGANIZATION**	Computer Architecture Stored Program concept, Number Representation (bits & bytes),Basic Computer Organization & Design, CPU – Components, Memory Organization – Primary, Secondary Memory, RAM/ ROM, Input -Output Organization – I/O devices.
2	**COMPUTER HARDWARE AND NETWORK**	Computer System layout, Installation and Configuration of Secondary Memory and BIOS, Installation of Different Devices, Troubleshooting Basics, OS Installation, Basics of networking, Network Layers -- physical layer, medium access sub layer, The data link layer, network layer, transport layer, session layer, presentation layer, application layer , LAN configuration- VLANS, Modems, Switches, Rooters, Wi-Fi, Security fundamentals – Firewall, Antivirus, DDOS attacks. Concept of internet and www, TCP/IP
3	**DATA STRUCTURE**	Elementary data organization, Preliminaries: Mathematical notation and function, string processing, Arrays, Record and pointes, Linked lists, stacks, Queues, Recursion, Trees – nodes, leaves, binary trees , Graphs – Graph Typesand their application, Sorting and Searching – Sorting and Searching Algorithms, File organization – File types, orientation.
4	**COMPUTER APPLICATION & PROGRAMMING**	Number System and Codes – decimal, binary, octal, hexadecimal, Operating System – concepts, installation, types, C & C++ Programming – Variables, Constants, Control Structures, Arrays, Pointers, Classes, Objects.
5	**OPERATING SYSTEM**	Processes, Process scheduling algorithms, Process Synchronization, Batch Processing, Time Sharing, Memory Management – Virtual Memory, Paging, Swapping, , File System – Allocation methods, Space Management, Input/output principals of I/O hardware & software, Device Management, Deadlocks – Handling deadlocks ,resource allocation, deadlock prevention algorithms, Distributed OS.

6	**INTERNET & WEB TECHNOLOGY**	Internet fundamentals, TCP/ IP internet layering model, internet application and services – websites, web servers, web technologies, scripting languages, XML, SSL certification, clientserver paradigm, CSS, HTML, e-Commerce, web publishing and browsing, Interactivity tools.
7	**VISUAL PROGRAMMING**	NET framework – Application Pools, Libraries, MSIL, CLR, CLS, Name spaces, assemblies, common language – VB, C#..NET features– supported platforms, authentication methods, crossplatform integration, data controls, Introduction to windows forms, Introduction to ADO.NET, data types and base class libraries, object oriented programming with VB.NET, visual inheritance apply inheritance techniques to forms, ASP.NET.
8	**DATABASE MANAGEMENT SYSTEMS**	Database Environment, Database System Concept and Application – database types, schema, subschema, tables, views, functions, stored procedures, constraints, schedulers, E-R diagram, SQL – query types, query statements, Functional Dependencies and Normalization for relational database, transaction processing concepts, concurrency control techniques, Security and Integrity, Distributed database.

(6)

ANNEXURE VI

Syllabus for Trade Test/ Written Test (Paper-III)

Mechanical Engineering (Post Code: TA20236)

Sl. No.	Topic	Details
1.	MATERIAL SCIENCE & ENGINEERING:	Materials and Manufacturing Processes: Engineering Materials, Classification and their Properties, Metal Casting, Moulding, Patterns, Metal Working, Metal Forming, Machine Tools and Machining Processes, Lathe Machine and types, Milling Machine and types, Shaper and Planer Machines: Differences, Operations, Failure analysis & Testing of Materials, Corrosion & Surface Engineering, Engineering plastics & fibers, Insulating materials.
2.	TOOL ENGINEERING:	Metal cutting, Cutting fluids: types; characteristics and applications, Types of Tool wear, Tool life calculation, Machinability, Tool material types, characteristics and applications, Cutting Tool Geometry, Types of dies and construction, Punch & Die mountings, Die Design Fundamentals, Forming and Drawing Dies
3.	MANUFACTURING ENGINEERING:	Cutting Fluids & Lubricants, Lathe Operations, Broaching Machines, Drilling, Welding, Milling, Press working operations, Principles of Grinding and finishing processes.
4.	MEASUREMENTS & METROLOGY:	Methods of measurements: Direct & Indirect; Standards of measurements, Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, Calibration, Errors in Measurements, Thread measurements: Thread gauge micro meter; Angle measurements: Bevel protractor, Sine Bar; Gauges: plain plug gauge, ring Gauge, snap gauge, limit gauge, Comparators: Characteristics and Types, Surface finish, surface roughness tester, Transducers and Strain gauges, Force measurement: Spring Balance, Proving ring, Load cell; Torque measurement: Prony brake, Eddy current, Hydraulic dynamometer; Pressure measurement: McLeod gauge; Classifications of tachometers, Displacement measurement, Flow measurement, Resistance thermometers, Optical Pyrometer, Humidity measurement, Density measurement, Liquid level measurement, Instruments for Angular Measurements; Screw thread measurements, Gear Measurement and Testing: Measurement of tooth thickness, Errors in gears; Machine tool testing: Parallelism, Straightness, roundness; Concept of Limits, Fits, and Tolerances; Hole and Shaft Basis System.
5.	STRENGTH OF MATERIALS:	Simple Stresses and Strains, Strain Energy, Shear Force & Bending Moment Diagrams, Theory of Simple Bending and Deflection of Beams, Torsion in Shafts and Springs, Thin Cylindrical Shells.
6.	ADVANCED MANUFACTURING PROCESSES:	Jigs & Fixtures, Jig Boring, Plastic Processing, and its fabrication methods, Modern Machining Processes, CNC Programming and Machining, CNC Turning Machine, CNC Milling Machines, Machine Tool Automation, Special

		Purpose Machines (SPM), Maintenance of Machine Tools, Computer Aided Machine Drawing: (Introduction).
7.	THEORY OF MACHINES & MECHANISMS:	Cams and Followers, Power Transmission, Flywheel and Governors, Brakes, Dynamometers, Clutches & Bearings, Balancing & Vibrations
8.	PRODUCTION OPERATIONS MANAGEMENT: &	Process Planning and Process Engineering, Production forecasting, Forecasting methods, Forecast accuracy, Scheduling, Break-Even Analysis, Aggregate Operations Planning, Assembly Line Balancing, Material Management
9.	THERMAL ENGINEERING	Basic concepts and gas laws, Laws of thermodynamics, Steam generator, Steam prime movers, Steam condensers, Heat transfer, Principles, Ignition, IC engines: Cooling, Lubrication
10.	REFRIGERATION & AIR CONDITIONING	Principles of refrigeration, Refrigeration methods, Units of refrigeration, Refrigeration systems and their applications, Refrigerants, Heat load calculations, Air-conditioning systems, window AC, split AC, central AC system and Heat Ventilation Air-conditioning system (HVAC), Evaporative cooling with example of desert cooler, water chillers and their applications
11.	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	Definition of voltage, current, power and energy with their units, advantage and applications of electricity, electromagnetic induction, domestic and industrial electromechanical installation, electrical motor, electrical safety, basic and digital electronics.
12.	ENVIRONMENTAL STUDIES AND RENEWABLE ENERGY	Natural resources, forest, water, mineral, energy and land resources, eco system, air, water, soil, noise and thermal pollution, environment protection act, air and water pollution act, solar, wind and tidal energy, Green building concept, Building rating.
13.	FIRE FIGHTING SYSTEM	Design and installation wet riser system, Sprinkler system, Fire alarm system, Water supply system and Fire & Industrial safety equipment.

(7)

ANNEXURE VII

Syllabus for Trade Test/ Written Test(Paper-III)

Chemistry (Post Code:TA20237)

Sl. No.	Topic	Details
1.	**Basic Concepts of Chemistry** (Organic, Inorganic and Physical Chemistry):	Importance and scope of chemistry, Laws of chemical combination, concept of elements, atoms and molecules. Atomic and molecular masses. Mole concept and molar mass; percentage; composition, empirical and molecular formula; chemical reactions. Organic Chemistry: IUPAC nomenclature
2.	**Structure of Atom:**	Atomic number, isotopes and isobars. Concept of shells and subshells, dual nature of matter and light, concept of orbital, quantum numbers, shapes of s, p and d orbitals, rules for filling electrons in orbitals, electronic configuration of atoms, stability of half-filled and completely filled orbitals.
3.	**Classification of Elements and Periodicity in Properties:**	Periodic table: s, p, d and f-Block Elements: Modern periodic law and long form of periodic table, periodic trends in properties of elements based upon electronic configuration, atomic radii, ionic radii, valence, Diagonal relationship, inert pair effect,, atomic and ionic radii, ionization energy.
4.	**Molecular Structure and Chemical Bonding**	Electrovalent, covalent and Coordination Compounds: Valence electrons, bond parameters, Lewis structure, polar character of covalent bond, valence bond theory, resonance, geometry of molecules, VSEPR theory, concept of hybridization involving s, p and d orbitals and shapes of some simple molecules. Weak Interactions: Hydrogen bonding, van der Waals forces. Hybridization, bond length, bond energy, bond angle, localised and delocalized pi – bonds, resonance, inductive effect and shapes of molecules and ions. Aromaticity.
5.	**States of Matter**	Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, Boyle's law, Charle's law, Avogadro's law, ideal behaviour of gases, empirical derivation of gas equation. Avogadro number, ideal gas equation. Liquid State-Vapour pressure, viscosity and surface tension.

6.	Thermodynamics	First, Second and Third law of Thermodynamics and Chemical Kinetics. Rate of a reaction (average and instantaneous), factors affecting rates of reaction.
7.	Redox Reactions	Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions in terms of loss and gain of electron and change in oxidation numbers.
8.	Equilibrium	Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of chemical equilibrium, equilibrium constant, ionic equilibrium-ionization of acids and bases, strong and weak electrolytes, degree of ionization, acid strength, concept of pH, Hydrolysis of salts (elementary idea), buffer solutions.
9.	Chemical Kinetics:	Concentration, temperature,; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half-life (only for zero and first order reactions); Method of determination of order of reaction.
10.	Hydrocarbons:	Alkanes, Alkenes, Alkynes; Alcohols, Aldehydes, Ketones, Carboxylic Acids, Phenols and Ethers (stereochemistry), Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions; Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation.
11.	Biomolecules	Carbohydrates- Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D.L. configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen): importance. Proteins- Elementary idea of – amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes. Hormones- lementary idea (excluding structure). Vitamins- Classification and function. Nucleic Acids: DNA and RNA
12.	Polymers	Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers like polyesters, bakelite; rubber,

		Biodegradable and non-biodegradable polymers.
13.	Surface Chemistry	Adsorption-physisorption and chemisorption; factors affecting adsorption of gases on solids catalysis homogeneous and heterogeneous, activity and selectivity: enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophillic, lyophobic multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsions- types of emulsions. concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenious equation, catalyst.
14.	General Principles and Processes of Isolation of Elements	Principles and methods of extraction- concentration, oxidation, reduction electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron. Actinoids: Electronic configuration, oxidation states and comparison with lanthanoids.
15.	Chromatography	Principle and application of TLC and paper Chromatography
16.	Spectroscopy	Principle, instrumentation and application of IR, UV
17.	Environmental Chemistry	Environmental pollution: Air, water and soil pollution, chemical reactions in atmosphere, smogs, major atmospheric pollutants; acid rain ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming-pollution due to industrial wastes; green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution.
18.	Chemistry in Everyday Life	Chemicals in medicines- analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines. Chemicals in food- preservatives, artificial sweetening agents, elementary idea of antioxidants. Cleansing agents- soaps and detergents, cleansing action.

ANNEXURE VIII

Syllabus for Trade Test/ Written Test(Paper-III)

Physics (Post Code:TA20238)

Sl. No.	Topic	Details
1.	**Mechanics**	Fundamentals of Dynamics, Work and Energy, Collisions, Rotational Dynamics, Elasticity, Fluid Motion, Gravitation and Central Force Motion, Oscillations, Non-Inertial Systems, Special Theory of Relativity
2.	**Electricity & Magnetism**	Electric Field and Electric Potential, Dielectric Properties of Matter, Magnetic Field, Magnetic Properties of Matter, Electromagnetic Induction, Electrical Circuits, Network Theorems.
3.	**Waves & Optics**	Superposition of Collinear Harmonic Oscillations, Superposition of Two Perpendicular Harmonic Oscillations, Wave Motion, Superposition of Two Harmonic Waves, Wave Optics, Interference, Interferometer Diffraction, Fraunhofer Diffraction, Holography, Polarization, Lens System, Aberrations, Resolving Power of Telescope and Microscope
4.	**Thermal Physics**	Zeroth and First Law of Thermodynamics, Second Law of Thermodynamics, Entropy, Thermodynamic Potentials, Maxwell's Thermodynamic Relations, Kinetic Theory of Gases, Distribution of Velocities, Molecular Collisions, Real Gases.
5.	**Digital Systems & Applications**	Integrated Circuits (qualitative treatment only), Digital Circuits, Boolean Algebra, Data Processing Circuits, Arithmetic Circuits, Sequential Circuits, Timers: IC 555, Shift Registers Counters (4 bits), Computer Organization, Intel 8085 Microprocessor Architecture, Introduction to Assembly Language.
6.	**Elements of Modem Physics**	Quantum Theory and Blackbody Radiation, Uncertainty and Wave-Particle Duality, Schrodinger Equation, One-dimensional Box and Step Barrier, Structure of the

		Atomic Nucleus, Radioactivity, Detection of nuclear radiation, Fission and Fusion, Lasers.
7.	**Analog Systems & Applications**	PN junction diode, Principle and Structure of (a) LEDs (b)Photodiode (c) Solar Cell, Bipolar Junction Transistors, Amplifiers, Coupled Amplifier, Feedback in Amplifiers, Sinusoidal Oscillators, Operational Amplifiers (Black Box approach), Applications of Op-Amps.
8.	**Quantum Mechanics & Applications:**	Time Dependent Schrodinger Equation,Time Independent Schrodinger Equation, Bound States, Hydrogen-like Atoms, Atoms in Electric & Magnetic Fields, Many Electron Atoms.
9.	**Solid State Physics**	Crystal Structure, Elementary Lattice Dynamics, Magnetic Properties of Matter, Dielectric Properties of Materials, Ferroelectric Properties of Materials, Free Electron Theory of Metals, Superconductivity.
10.	**Electromagnetic Theory**	Maxwell Equations, EM Wave Propagation in Unbounded Media, EM Wave in Bounded Media, Poynting's Theorem, Optical Fibres, Structure, pulse dispersion & modes of propagation
11.	**Statistical Mechanics**	Classical Statistics, Classical Theory of Radiation, Quantum Theory of Radiation, Bose-Einstein Statistics, Fermi-Dirac Statistics.
12.	**Instrumentation**	CRO and applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers Calculation of Ripple Factor, Basic idea about capacitor filter, Zener Diode and Voltage Regulation Multimeter

(9)

ANNEXURE IX

Syllabus for Trade Test/Written Test (Paper III)

Geology (Post Code: TA20239)

Geomorphology

Topography and topographic maps. Characteristics geomorphological features in glacial, fluvial, aeolian, arid, coastal and igneous environments. Geomorphological provinces in India.

Mineralogy

Definition and classification of rock forming minerals and their physical properties. Mohs scale of hardness.

Identification of common rock-forming minerals in hand specimens.

Characteristic optical properties of different rock-forming minerals.

Structural Geology:

Outcrop patterns of simple dipping beds. Contours and stratum contours.Maps and cross-sections. Strike, true dip and apparent dip. Outcrop patterns of simple dipping beds and rule of V. 3-point problem. Pitch/rake and plunge.

Stress and strain in rocks.

Geometric classification and outcrop patterns of folds. Common mechanism of folding

Classification and origin of different types of foliation and lineation. Relationship of foliation and lineation with folds.

Geometric and genetic classification of fractures and faults. Effects of faulting on the outcrops

Joints: Definition, classification and origin, and their geological significance

Igneous Petrology

Introduction to Igneous Petrology. Classification and origin of igneous rocks. Igneous texturesand structures. Identification of igneous rocks in hand specimens. Characteristic occurrences of igneous rocks on different types of plate boundaries.

Metamorphic Petrology

Definition of metamorphism. Factors controlling metamorphism. Types of metamorphism. Index minerals. Metamorphic facies, metamorphic textures and structures. Schists, gneisses, khondalites, charnockites, blueschists and eclogites.

Sedimentary Geology

Origin of sediment. Weathering and sedimentary flux: Physical and chemical weathering. Grain size scales Udden-Wentworth and Krumbein (phi) scale, particle size distribution; mean, median, mode. Sediment transport, deposition and diagenesis. Sedimentary textures, structures and environment. Soft-sediment deformation structures.

Classification of clastic and non-clastic sedimentary rocks and their characteristic megascopic and microscopic properties.

Stratigraphy of India

Geological time scale. Principle of superposition and uniformitarianism. Type area and stratigraphic equivalents. Stratigraphic-correlation. Precambrian and Phanerozoic stratigraphy of India. Precambrian-Cambrian, Permian-Triassic, Cretaceous-Tertiary boundaries in India.

Engineering Geology

Role of geology in major engineering projects. Uniaxial compressive, tensile and shear strength of rocks. Mohr circle. Rock Quality Designation (RQD), Rock Structure Rating (RSR), Rock Mass Rating (RMR) and Tunnelling Quality Index (Q). Important geological considerations in planning and design of dams, roads and tunnels. Environmental considerations in engineering geological projects.

Plate tectonics

Continental drift. Concept of plate tectonics. Sea-floor spreading. Different types of plate boundaries. Earthquake and volcanic belts on plate boundaries, triple junctions. Modern day examples of the three types of plate boundaries. Wilson cycle. Paleomagnetism. Plate boundary mineralization.

Hydrogeology

Hydrologic cycle: precipitation, evapo-transpiration, run-off, infiltration and subsurface movement of water. Rock properties affecting groundwater. Vertical profile of subsurface water. Types of aquifer, aquifer parameters, anisotropy and heterogeneity of aquifers. Darcy's law and its validity. Intrinsic permeability and hydraulic conductivity. Laminar and turbulent groundwater flow. Basic concepts of water balance studies. Groundwater level fluctuations; Rainwater harvesting and artificial recharge of groundwater.

(15)

ANNEXURE X

Syllabus for Trade Test/ Written Test(Paper III)

Library & Information Science (Post Code:TA202310)

Sl. No.	Topic	Details
1.	Foundations of Library & Information Science:	Development of libraries, Role of Libraries in Society, Laws of Library Science, Types of libraries. Librarianship as a Profession, Library Legislation, Library co-operation & Resource sharing, Professional Associations: National & International Associations
2.	Reference Service & Information Sources	Reference Service, Types of Reference Service, Organization & Management of Reference Department, reference sources. Study and evaluation of reference sources, Reference Questions, User Education.
3.	Information Science	Documentation and Information Science, Sources of Information, Information & information needs of users, Information Transfer: Communication of Information. Information services, Information Systems &Information Networks and Centers.
4.	Knowledge Organization	Classification, Universe of Knowledge-Structure and attribute, Normative Principles of Classification & their application. Species of classification schemes, Standard schemes of classification and their features, Colon Classification, Dewey Decimal Classification and Universal Decimal Classification, Trends in library classification. Information storage and retrieval, Indexing (Pre and Post Co-ordinate)
5.	Document Description	Parts of a book, Library catalogue and its forms, Catalogue Entries, Normative Principles of Cataloguing. Principles and practices of document description, Standardization in description and bibliographic exchange, Subject cataloguing, Bibliographic control, Co-operation and Centralization in

		Cataloguing, Metadata Standards and Protocols: MARC-21, Z-39.50, Dublin Core etc.
6.	Information Technology Application in Libraries	Introduction and Communication Technology, Computer Application to Libraries & Information Centers, Networking and Internet, Library Automation, Plagiarism Detection Tools, High performance scanner, Printers, RFID, Barcode Technology Innovative Library Services by using technology
7.	Library Management	Management of Collection and Resources, Collection maintenance, HRM & Financial management, Reporting. Audit: Accession Register, Asset Abstract Register (AAR), Issue- Return Register, Visitor Register User Orientation Program Library Security: CCTV Camera, Security Guard, Close access, Pest Control, other Physical Security measures
8.	Library Automation and Digitization	Library Automation software: Koha, Libsys, Egranthalaya, Digital Library Software: Dspace, Eprint, Greenstone
9.	Digital Information Resources	E-Journals Consortiums, Resource sharing, Digital Object Identifier (DOI), Patent Databases, Standards, E-books, ISSN/ISBN/RNI
10.	Scientometrics and Bibliometrics	Citation Analysis of Research & Development papers published, Indicators of Research Evaluation, Impact Factor, H-Index, i10 Index, Bibliometric Databases: Web of Science, Scopus etc.
11.	Binding, Stock Verification and Weeding-Out	Binding of Loose Journals, Books, Documents, Thesis, Research Reports, Project Reports etc. Physical Stock Verification and Weeding out of Obsolete Publications