REVISED ANNEXURE-II

Syllabus of Examination for non-teaching positions in NITs and other Institutions under Ministry of Education

Common Recruitment Examination - 2023

The Syllabus is suggestive and indicative in nature having only broader areas for reference. The Candidate is expected to have the holistic and expanded knowledge of the subject/syllabus.

1. Office Attendant/Lab Attendant/MTS:

General Awareness: Includes questions relating to History, Indian Polity & Constitution, Art & Culture, Geography, Economics, General Policy, Science & Scientific Research, National/International Organizations /Institutions, current events, environment etc.

Reasoning: Includes questions relating to both verbal and non-verbal types, analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc.

Mathematics: Includes questions relating to Simplification, Decimals, Fractions, L.C.M., H.C.F., Ratio & Proportion, Percentage, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Time & Work, Time & Distance, Tables & Graphs, etc.

Test of English or Hindi: In addition to the testing of candidate's understanding of the English or Hindi Languages, it's Vocabulary, Grammar, Sentence Structure, Synonyms, Antonyms and its correct usage etc. would also be tested.

Computer Awareness: Includes questions on Operating System, MS Office, MS Word, MS Excel, Power Point, Tally, Internet, E-mail, Antivirus and various online tools used in day- to-day office work.

2. Junior Assistant

General Awareness: Includes questions relating to History, Indian Polity & Constitution, Art & Culture, Geography, Economics, General Policy, Science & Scientific Research, National/International Organizations /Institutions, current events, environment etc.

Reasoning: Includes questions relating to both verbal and non-verbal types, analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc.

Mathematics: Includes questions relating to Simplification, Decimals, Fractions, L.C.M., H.C.F., Ratio & Proportion, Percentage, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Time & Work, Time & Distance, Tables & Graphs, etc.

Test of English or Hindi: In addition to the testing of candidate's understanding of the English or Hindi Languages, it's Vocabulary, Grammar, Sentence Structure, Synonyms, Antonyms and its correct usage etc. would also be tested.

Computer Awareness: Includes questions on Operating System, MS Office, MS Word, MS Excel, Power Point, Tally, Internet, E-mail, Antivirus and various online tools used in day- to-day office work.

General Administration: Constitution of India, CCS Leave Rules, CCS Conduct Rules, LTC Rules, TA/DA

Rules and other Allowances, Office Procedure, Probation, Confirmation, Resignation, General Financial Rules-2017 & 2022, GeM Rules, Medical Attendance Rules & CGHS, etc

3. Technician

PART A:

General Awareness: Includes questions relating to History, Indian Polity & Constitution, Art & Culture, Geography, Economics, General Policy, Science & Scientific Research, National/International Organizations /Institutions, current events, environment etc.

Reasoning: Includes questions relating to both verbal and non-verbal types, analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc.

Mathematics: Includes questions relating to Simplification, Decimals, Fractions, L.C.M., H.C.F., Ratio & Proportion, Percentage, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Time & Work, Time & Distance, Tables & Graphs, etc.

Test of English or Hindi: In addition to the testing of candidate's understanding of the English or Hindi Languages, it's Vocabulary, Grammar, Sentence Structure, Synonyms, Antonyms and its correct usage etc. would also be tested.

Computer Applications: Includes questions on Operating System, MS Office, MS Word, MS Excel, Power Point, Tally, Internet, E-mail, Antivirus and various online tools used in day- to-day office work.

PART B:

- **Civil**

Computer awareness: Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc. Internet, MS-DOS, Data Entry, Softwares knowledge, applications of computers in civil engineering

Surveying: Introduction, History and principles of chain survey. Classification, accuracy, types of chains and tapes. Direct and Indirect ranging.

Compass survey: Instrument and its setting up, Bearing and each included angle of close traverse. Local attraction. Magnetic declination and its true bearing. Precaution in using prismatic compass.

Levelling: Auto level, dumpy Level, Tilting Level - introduction, definition · Principle of levelling. Levelling staffs, its graduation & types. Temporary and permanent adjustment, procedure in setting up. Level & horizontal surface. Datum Benchmark, Focusing & parallax Deduction of levels / Reduced Level. Types of leveling, Application to chain and Levelling Instrument to Building construction. Reciprocal levelling.

Contouring: Definition, Characteristics, Methods. Direct and Indirect methods · Interpolation of Contour, Contour gradient, Uses of Contour plan and Map. Application of contouring for road project.

Theodolite survey: Introduction. Types of theodolite. Uses, Methods of Plotting. Transit vernier theodolite. Terms of transit theodolite. Fundamental line of theodolite. Adjustment of theodolite.

Total Station: Introduction. Components parts, accessories used.

GPS (Global Positioning System): Introduction of GPS system. Definition and application of Remote sensing.

Water supply: Introduction. Terms used in PHE. Various types of water supply pipes and fittings. Material specification. Type of overhead and underground water tanks. Tools and equipment's used in water supply system. Basic concept, terminology and process used in Water treatment plant ·

Systems of sanitation: System of house drainage, plumbing, sanitary fittings, etc. Types of sewer appurtenance, Systems of plumbing. Type of sewage disposals.
Manholes, soak pit & Septic tank. Basic concept, terminology and process used in Sewerage treatment plant.

- **Electrical**

Mathematics: Arithmetic, Geometric and Harmonic Progressions, Binomial expansion, Matrices, Elementary operations, Rank of a matrix Parabola, Ellipse and Hyperbola, Differentiation of a function, implicit function, parametric function. Successive differentiation. Maxima and Minima, Partial Differentiation, Definite and indefinite Integration. First order and first degree ordinary differential equations. **Physics:** Units and Dimensions with Dimensional analysis and their Limitation, Motion in one and two dimensions and Newton's Laws of Motion. Work and Energy and Conservation Laws of energy, Properties of matter i.e. Elasticity, Surface tension and viscosity in fluent motion, waves and vibration. Characteristics of waves and Simple Harmonic Motion, Rotational Motion, Conservation on angular momentum, Gravitation, Newton's law of gravitation, Kepler's law and Satellite, Heat and temperature. Measurement of temperature and mode of transfer of hear and their laws, geometric optics and simple optical instruments, Simple Law of electrostatics and their use to find the E and potential. Capacitors and dielectric constant, Laser, its principle and use, Superconductivity, Conventional and Non-Conventional energy sources.

Elements of Electrical Engineering:

Electrical and Magnetic circuits, EMF, Kirchhoff's law and Faraday's Laws, Network Theorems, AC circuit, RMS value

Behavior of RIC elements, Series and parallel circuits, series and parallel resonance circuits, Transformers, Introduction to single phase and three phase transformers DC Machines, Theory, Constructions and Operation of three phase induction motors, Transmission and Distribution

Advantages of high voltages for transmission, Comparison of 3 phase, single phase, 2 Phase and three wire D.C. Systems.

Elements of Electronic Engineering:

Measurements & Instrumentations, Errors, standards, accuracy precision resolution, Ammeters, Voltmeters, watt meters

Energy meters, insulation tester, multimeter, CRO, measurement of V, I & F on CRO low, medium & high resistance measurement, AC bridges

Transducers for measurement of temperature, displacement, communication system, types of modulation, demodulation, Analog Electronics

Semiconductor diode circuits, zener diode and zener diode circuits, LED, photo diode, BJT, FET & their configurations and characteristics

Biasing, small signal and Large signal amplifier, OP-AMPS, oscillators, regulated power supply.

COMPUTER LITERACY: Characteristics of Computer, Computer Organization, Input/output Devices, Computer Software-Relationship between Hardware and Software, Operating Systems, MS-Office (exposure of Word, Excel/spread sheet, Power point). Digital Signature, Application of information technology in Government for e-Governance, mobile/Smartphone, Information tasks.

- **Mechanical**

Computer awareness: Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc. Internet, MS-DOS, Data Entry, Softwares knowledge, applications of computers in mechanical engineering
Automobile Engineering: Automobile and its development, Classification of automobiles, Transmission System, Steering System, Braking System, Dynamo and Alternator and Exhaust Emissions
Computer Integrated Manufacturing: Introduction to NC, CNC & DNC, Construction and Tooling, Part Programming, System Devices, Problems in CNC Machines, Automation and NC system
Engineering Materials: Scope of Material Science, Crystallography, Metals and Alloys, Heat Treatment, Plastics and Advanced Materials
Engineering Mechanics: Laws of Forces, Moment, Friction, Centre of Gravity and Simple Machines
Fluid Mechanics: Type and Properties of Fluids, Pressure and its Measurement, Flow of Fluids and Flow through Pipes
Heat-Transfer: Modes of Heat Transfer, Fourier's Law, Steady State Conduction, Composite Structures, Natural and Forced Convection and Thermal Radiation
I.C. Engines: Working principle of two stroke and four stroke cycle, SI engines and CI Engines, Otto cycle, Diesel cycle, Dual cycle, Fuel Supply and Ignition System in Petrol Engine, Fuel System of Diesel Engine, Cooling and Lubrication and Testing of IC Engines
Machine Design: Design-Definition, Types of design, necessity of design, Design terminology: stress, strain, factor of safety, factors affecting factor of safety, stress concentration, methods to reduce stress concentration, fatigue, endurance limit, Design Failure, Design of Shaft, Design of Key, Design of Joints, Design of Flange Coupling and Design of Screwed Joints
Machining and Machine Tool Operations: Cutting Tools and Cutting Materials, Lathe, Drilling, Boring, Shaping and Planing, Broaching, Jigs and Fixtures and Cutting Fluids and Lubricants, Welding, Pattern Making, Metal Forming Processes **Mechanics of Materials:** Stresses and Strains, Resilience, Moment of Inertia, Bending Moment and Shearing Force, Bending Stresses, Columns, Torsion and Springs
Metrology and Inspection: Linear and Angular Measurement, Measurement of Surface Finish and Measurements of Screw threads and Gauges
Refrigeration and air-conditioning: Fundamentals of Refrigeration, Vapour Compression System, Refrigerants, Air Refrigeration System, Vapour Absorption System and Refrigeration Equipment
Theory of Machines: Simple Mechanisms, Friction, Power Transmission, Flywheel, Governor and Balancing
Thermodynamics: Fundamental Concepts, Laws of Perfect Gases, Thermodynamic Processes on Gases, Laws of Thermodynamics, Ideal and Real Gases and Properties of Steam
Turbo-machinery: Introduction to Turbomachines, Classification of Turbomachines, Steam Turbines and Steam Condensers, Gas Turbines and Jet Propulsion
Vibrations: Types-Longitudinal, Transverse and Torsional vibrations, Dampening of Vibrations, Causes of vibrations in Machines, their Harmful Effects and Remedies. -ECE

- **ECE**

1. **Computer awareness:** Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc. Internet, MS-DOS, Computer Generation & Development, UNIX, Windows, Lotus, SmartSuite, Data Entry, Softwares knowledge, Networking Platforms, applications of computers in electrical engineering
2. **Basic concepts:** Concepts of resistance, inductance, capacitance, and various factors affecting them. Concepts of current, voltage, power, energy and their units., Kirchhoff 's law, Simple Circuit solution using network theorems. Concepts of flux, mmf, reluctance, Magnetic calculations for conductors of different configuration e.g. straight, circular, solenoidal, etc. Electromagnetic induction, self and mutual induction. Instantaneous, peak, R.M.S. and average values of alternating waves, Representation of sinusoidal wave form, simple series and parallel AC Circuits consisting of R.L. and C, Resonance, Tank Circuit. Poly Phasesystem – star and delta connection, 3 phase power, DC and sinusoidal response of R-Land R-C circuit.
3. **Fundamentals of Electronics Engineering:** Semiconductor Diode, PN junction, basic principles of operation and VI characteristics of PN junction diode, static and dynamic resistance of a diode. Applications of Diode Use of a diode in rectifiers, half wave, full wave and bridge rectifier with shunt capacitor filter, series inductor filter, zener diode and its applications, as a voltage regulator, light emitting diode (LED), Transistor: Introduction to a transistor, working of a PNP and NPN transistor, input and output characteristics, transistor configurations.
4. **Digital Electronics** 1. Number System. 2. Binary addition, subtraction, multiplication and division including binary points 3. Logic Gates and Families a) Concept of negative and positive logic b) Definition, symbols and truth tables of gates. Construction of NOT, AND and OR gates from NAND and NOR gates (universal gates). 5. Logic Simplification a) Postulates of Boolean algebra, DeMorgan's Theorems.
5. **Power Electronics** 1. Introduction to thyristors and other Power Electronics Devices SCR – Different methods of SCR triggering. - Different commutation circuits for SCR. - Construction & working principle of DIAC, TRIAC & their V-I characteristics 2. Controlled Rectifiers
6. **Electrical Machines:** (a): D.C. Machine – Construction, Basic Principles of D.C. motors and generators, their characteristics (b): 1 phase and 3 phase transformers – Construction, Principles of operation, equivalent circuit, Tests, Losses and efficiency. (c):3 phase induction motors, rotating magnetic field,
principle of operation, equivalent circuit, torque-speed characteristics.
7. **Unit and Measurement**: Definition, Classification, Fundamental and derived units, systems of units: FPS, CGS, MKS, Unit of physical quantities, symbols, Conversion factors, Measurements of mechanical quantities, electrical quantities.
8. **Work Power and Energy**: Definition, Work and its units, Measurements of Work, Work done on bodies moving on horizontal and inclined planes (Consider frictional forces also) Concept of Power and its units, Calculations of Power (Simple cases).
9. **Measurement and measuring instruments**: Measurement of power (1phase 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 Generator, CT, PT and their uses.

10. **Sensors and Industrial Instrumentation**: Resistive Capacity, Inductive, piezometric, Half effect sensors and associated signal conditioning circuits, Transducers for industrial instrumentation, Displacement (Linear and Angular).

- **Computer Engineering**

Computer Organization and Architecture

Binary representation, registers, Instruction set, timing and control, CPU, instruction cycle, addressing modes, CISC, RISC, synchronization, interrupt and exception, privileged and non-privileged instruction, hierarchical memory organization, memory mapping, cache memory, coherence, consistency, virtual memory, interleaving, DMA, Signed number, fixed and floating point numbers, control unit design, arithmetic and instruction pipelining: throughput, speedup, branch prediction, hazards

Programming, Data Structures, Algorithms, and Theory of Computation

Programming in C, pointers, basic data structures, array, string, stack, queue, recursion, linear and non-linear data structures, searching and sorting algorithms, complexity and asymptotic analysis, Mealy and Moore machine, finite automata, Determinism and non-determinism, Regular expressions, minimization of deterministic finite automata PDA, regular grammar, CFG, Chomsky's hierarchy, closure properties, pumping lemma, Turing machine, halting problem

Operating System and Database Systems

Basics of Popular Operating Systems (Linux & Wndows), File and Directory Management, purpose of database system, Data Models, ER-Model, Introduction to UML, keys, integrity rules, Relational Database design, Normalization, Selection and projection, Joins, SQL: data definition, aggregate function, Null Values, nested sub queries, joined relations, ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods **Computer Networks and Web technologies Basic of Computer networks;** LAN, WAN, OSI reference model, TCP/IP, sliding window protocol, Channel allocations problem, Ethernet, Wireless LAN, Broadband Wireless, routing algorithms, Congestion control algorithms, IPv4 and IPv6, Quality of Service, UDP and TCP, Domain name system, electronic mail, World Wide **Web:** architectural overview, dynamic web document and http, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet, Concept of Internet, Applications of Internet, Search Engines

- **Chemistry**

Some Basic Concepts of Chemistry

Importance of Chemistry, Nature of Matter, Properties of Matter and their Measurement, Uncertainty in Measurement , Laws of Chemical Combinations, Dalton’s Atomic Theory, Atomic and Molecular Masses, Mole Concept and Molar Masses, Percentage Composition, Stoichiometry and Stoichiometric Calculations **Structure of Atom**

Discovery of Sub-atomic Particles, Atomic Models, Developments Leading to the Bohr’s Model of Atom, Bohr’s Model for Hydrogen Atom, Towards Quantum Mechanical Model of the Atom, Quantum Mechanical Model of Atom

Classification of Elements and Periodicity in Properties

Why do we Need to Classify Elements ?, Genesis of Periodic Classifications, Modern Periodic Law and the Present Form of the Periodic Table, Nomenclature of Elements with Atomic Numbers > 100 , Electronic Configurations of Elements and the Periodic Table, Electronic Configurations and Types of Elements: s-, p-, d-, f- Blocks, Periodic Trends in Properties of Elements

Chemical Bonding and Molecular Structure

Kössel-Lewis Approach to Chemical Bonding, Ionic or Electrovalent Bond, Bond Parameters, The Valence Shell Electron Pair Repulsion (VSEPR) Theory, Valence Bond Theory, Hybridisation, Molecular Orbital Theory, Bonding in Some Homonuclear Diatomic Molecules , Hydrogen Bonding

Thermodynamics

Thermodynamic Terms , Applications, Measurement of ΔU and ΔH: Calorimetry, Enthalpy Change, ΔrH of a Reaction – Reaction Enthalpy, Enthalpies for Different Types of Reactions, Spontaneity, Gibbs Energy Change and Equilibrium **Equilibrium**

Equilibrium in Physical Processes, Equilibrium in Chemical Processes – Dynamic Equilibrium, Law of Chemical Equilibrium and Equilibrium Constant, Homogeneous Equilibria, Heterogeneous Equilibria, Applications of Equilibrium Constants , Relationship between Equilibrium Constant K, Reaction Quotient Q and Gibbs Energy G, Factors Affecting Equilibria, Ionic Equilibrium in Solution, Acids, Bases and Salts, Ionization of Acids and Bases, Buffer Solutions, Solubility Equilibria of Sparingly Soluble Salts

Redox Reactions

Classical Idea of Redox Reactions-Oxidation and Reduction Reactions, Redox Reactions in Terms of Electron Transfer Reactions, Oxidation Number, Redox Reactions and Electrode Processes

Organic Chemistry – Some Basic Principles and Techniques

General Introduction, Tetravalence of Carbon: Shapes of Organic Compounds, Structural Representations of Organic Compounds, Classification of Organic Compounds, Nomenclature of Organic Compounds, Isomerism, Funda
mental Concepts in Organic Reaction Mechanism, Methods of Purification of Organic Compounds, Qualitative Analysis of Organic Compounds, Quantitative Analysis **Hydrocarbons**

Classification, Alkanes, Alkenes, Alkynes, Aromatic Hydrocarbon, Carcinogenicity and Toxicity

Solutions

Types of Solutions, Expressing Concentration of Solutions, Solubility, Vapour Pressure of Liquid Solutions, Ideal and Non-ideal Solutions, Colligative Properties and Determination of Molar Mass, Abnormal Molar Masses

Electrochemistry

Electrochemical Cells, Galvanic Cells, Nernst Equation, Conductance of Electrolytic Solutions, Electrolytic Cells and Electrolysis, Batteries, Fuel Cells, Corrosion **Chemical Kinetics**

Rate of a Chemical Reaction, Factors Influencing Rate of a Reaction, Integrated Rate Equations, Temperature Dependence of the Rate of a Reaction, Collision Theory of Chemical Reactions

The d-and f-Block Elements

Position in the Periodic Table,Electronic Configurations of the d-Block Elements, General Properties of the Transition Elements (d-Block),

Some Important Compounds of Transition Elements, The Lanthanoids, The Actinoids, Some Applications

Coordination Compounds

Werner's Theory of Coordination Compounds, Definitions of Some Important Terms Pertaining to Coordination Compounds, Nomenclature of Coordination Compounds, Isomerism in Coordination Compounds, Bonding in Coordination Compounds, Bonding in Metal Carbonyls, Importance and Applications of Coordination, Compounds

Haloalkanes and Haloarenes

Classification, Nomenclature, Nature of C–X Bond, Methods of Preparation of Haloalkanes, Preparation of Haloarenes, Physical Properties, Chemical Reactions, Polyhalogen Compounds

Alcohols, Phenols and Ethers

Classification, Nomenclature, Structures of Functional Groups, Alcoho ls and Phenols, Some Commercially Important Alcohols, Ethers.

Aldehydes, Ketones and Carboxylic Acids

Nomenclature and Structure of Carbonyl Group, Preparation of Aldehydes and Ketones, Physical Properties, Chemical Reactions, Uses of Aldehydes and Ketones, Nomenclature and Structure of Carboxyl Group, Methods of Preparation of Carboxylic Acids, Physical Properties, Chemical Reactions, Uses of Carboxylic Acids **Amines**

Structure of Amines, Classification, Nomenclature, Preparation of Amines, Physical Properties, Chemical Reactions, Method of Preparation of Diazonium Salts, Physical Properties, Chemical Reactions, Importance of Diazonium Salts in Synthesis of Aromatic Compounds

Biomolecules

Carbohydrates, Proteins, Enzymes,Vitamins, Nucleic Acids, Hormones

- **Computer Application**

1. Computer Organization and Architecture Binary representation, registers, Instruction set, timing and control, CPU, instruction cycle, addressing modes, CISC, RISC, synchronization, interrupt and exception, privileged and non-privileged instruction, hierarchical memory organization, memory mapping, cache memory, coherence, consistency, virtual memory, interleaving, DMA, Signed number, fixed and floating point numbers, control unit design, arithmetic and instruction pipelining: throughput, speedup, branch prediction, hazards
2. Programming, Data Structures, Algorithms, and Theory of Computation Programming in C, pointers, basic data structures, array, string, stack, queue, recursion, linear and non-linear data structures, searching and sorting algorithms, complexity and asymptotic analysis, Mealy and Moore machine, finite automata, Determinism and non-determinism, Regular expressions, minimization of deterministic finite automata PDA, regular grammar, CFG, Chomsky's hierarchy, closure properties, pumping lemma, Turing machine, halting problem
3. Operating System and Database Systems Basics of Popular Operating Systems (Linux & Windows), File and Directory Management, purpose of database system, Data Models, ER-Model, Introduction to UML, keys, integrity rules, Relational Database design, Normalization, Selection and projection, Joins, SQL: data definition, aggregate function, Null Values, nested sub queries, joined relations, ACID properties,

serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods

4. Computer Networks and Web technologies Basic of Computer networks; LAN, WAN, OSI reference model, TCP/IP, sliding window protocol, Channel allocations problem, Ethernet, Wireless LAN, Broadband Wireless, routing algorithms, Congestion control algorithms, IPv4 and IPv6, Quality of Service, UDP and TCP, Domain name system, electronic mail, World Wide
5. Web: architectural overview, dynamic web document and http, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet, Concept of Internet, Applications of Internet, Search Engines

○ Architecture

Section 1: Architecture and Design

Visual composition in 2D and 3D; Principles of Art and Architecture; Organization of space; Architectural Graphics; Anthropometrics; Planning and design considerations for different building types; Site planning; Circulation- horizontal and vertical; Barrier free design; Space Standards; Building Codes; National Building Code.

Elements, construction, architectural styles and examples of different periods of Indian and Western History of Architecture; Vernacular and Traditional architecture.

Section 2: Computer awareness

Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc. Internet, MS-DOS, Data Entry, Softwares knowledge, applications of computers in civil engineering; Computer Graphics – concepts of CAD, BIM, 3D modeling and Architectural rendition.

Section 3: Building Materials, Construction

Behavioral characteristics and applications of different building materials viz. mud, timber, bamboo, brick, concrete, steel, glass, FRP, AAC, different polymers, composites.

Building construction techniques, methods and details; Building systems and prefabrication of building elements; Principles of Modular Coordination; Estimation, specification, valuation, professional practice; Construction planning and equipment.

Section 4: Building and Structures

Principles of strength of materials; Design of structural elements in wood, steel and RCC; Elastic and Limit State design; Structural systems in RCC and Steel; Form and Structure; Principles of Prestressing; High Rise and Long Span structures; Principles and design of disaster resistant structures.

Section 5: Environmental Design

Ecosystem - natural and man-made ecosystem; Ecological principles; Concepts of Environmental Impact Analysis; Environmental considerations in planning and design; Thermal comfort, ventilation and air movement; Principles of lighting and illumination; Climate responsive design; Solar architecture; Principles of architectural acoustics; Green Building - Concepts and Rating; ECBC; Building Performance Simulation and Evaluation.

Section 6: Site Planning and Landscape

Site planning; Landscape design; Development controls – FAR, densities and building byelaws.

Section 7: Building Services

Building Services: Water supply; Principles of water supply and sanitation systems; water treatment; Water supply and distribution system; Water harvesting systems; Principles, Planning and Design of storm water drainage system.

Sewerage and drainage systems; Sewage disposal methods; Sanitary fittings and fixtures; Plumbing systems; Principles of internal and external drainage system.

Electrical system; Principles of electrification of buildings; Power Supply and Communication Systems.

Air -Conditioning systems; Firefighting Systems; Building Safety and Security systems.

Solid waste management; Methods of solid waste management - collection, transportation and disposal; Recycling and Reuse of solid waste.

Intelligent Buildings; Elevators and Escalators.

- **Information Technology**

1. **Hardware**
   Assembling of PC, Installation of Systems and troubleshooting, BIOS settings, Installation and testing of a printer, Printer Maintenance, Scanner Installation, Webcam Installation, making various types of cables for networking, Installation and Maintenance of UPS Systems, Installation and maintenance of various networking devices like Router, Switches, Laying out Structured cabling, Installation of Firewalls and Connectivity of LAN & WAN, Installation of Wireless network devices.
2. **Software**
   Debugging C/ C++ Programs, Installation and Administration of SQL, Installation of various variants of operating systems like Windows and Linux, Application & Troubleshooting, Upgrading OS, Backup, format & restore OS, Installation of Software like Visual Studio, UML, Cisco Packet tracer, Working of MS-Office components like Word, Excel & PowerPoint, Configuring and sharing internet in PCs and other devices, configuring firewalls &Usage of access lists, Working with Wireless Networks (Installation & Configuration)
3. **Programming and Data Structure**
   C Language, Object oriented Programming, Functions, Data type, Recursion, Arrays, Stacks, Queues, Searching and Sorting algorithms.
4. **Web Designing**
   HTML and CSS, SQL, JavaScript, Different Browser setup.
5. **Networking and Security**
   Basics of computer network, OSI Model, Transmission Media, Networking devices Network Topology, LAN Basics, IP Addressing, TCP/IP, Ethernet Advanced, Structured Cabling, Wireless Networking, connecting a PC/Laptop to Internet, installing a printer and sharing it in Network, Joining a workgroup/domain, File sharing and troubleshooting, Remote Access, Basics of Wi-Fi, Internet security

- **Central Workshop**

1. Computer awareness: Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc. Internet, MS-DOS, Data Entry, Softwares knowledge, applications of computers in mechanical engineering
2. Welding Type of welding (Arc welding & gas welding), TIG & MiG welding, Brazing and soldering, welding defects, maintenance of tools and machines
3. Turning Basic principle of turning, description and specification of lathe machine, operations of lathe e.g. turning, taper turning, kurling, thread cutting etc., maintenance of lathe.
4. Machining Metal cutting principles, cutting tool, basic principles of machining with milling and drilling, shaping machine, grinding etc., machining tool, maintenance of machines.
5. Fitting Functions and working of fitting tools such as files, chisels, scrapers, try squares etc., maintenance of all tools.
6. CNC Operation Components and function of CNC operation, handling of CNC machines, ro
7. Metrology and Inspection Linear and Angular Measurement, Measurement of Surface Finish and Measurements of Screw threads and Gauges

8. Mechanics of Materials Stresses and Strains, Resilience, Moment of Inertia, Bending Moment and Shearing Force, Bending Stresses, Columns, Torsion and Springs
9. Engineering Materials Scope of Material Science, Crystallography, Metals and Alloys, Heat Treatment, Plastics and Advanced Materials
10. Engineering Mechanics Laws of Forces, Moment, Friction, Centre of Gravity and Simple Machines

- **Chemical Engineering**

1. Distance and displacement, Scalar and Vector quantities, Speed and velocity, motion, mass and weight, momentum, impulse, laws of motion, conservation of momentum, work, power and energy, conservation of energy, laws of reflection and refraction, refraction through a glass slab and prism, Ohm's law, Law of resistance in series and parallel, electric power.
2. Atomic and molecular mass, mole concept, Avogadro's Number, Avogadro's law, ideal gas, gas laws, diffusion, isotopes and isobars in an atom, Postulates of Bohr's theory, Periodic classification of elements and gradation of properties, electrovalent, covalent and co-ordinate bonds, Chemical Kinetics, Electrochemistry, Surface Chemistry, Phase Rule, Distribution Law, True solution, colloids and suspension, strong and weak electrolytes. Acids, bases and salts, pH of a solution, Rate of the reaction and factors affecting the rate of the reaction, Oxidation and reduction, IUPAC Nomenclature, Aliphatic compounds, Aromatic compound, Carbohydrates and Polymers.
3. Introduction and concepts of Mechanical Operations, particulate solids, Screen Analysis, Size Reduction, Sedimentation, Filtration.
4. General Introduction & Concept of Safety, Chemical & Fire Hazards & their Control, Other hazards & occupational diseases, Personal Protective Devices, Introduction to pollution, Air Pollution, Water pollution, Solid waste disposal.
5. Steady State Heat Transfer by conduction, Convection and Radiation, Heat Exchangers, Evaporation, diffusion, absorption, distillation, Humidification and Dehumidification, Drying, Leaching, Extraction

- **Bio Medical Engineering**

1. Computer awareness: Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc.
2. Basic concepts: Concepts of resistance, inductance, capacitance, and various factors affecting them. Concepts of current, voltage, power, energy and their units., Kirchhoff 's law, Simple Circuit solution using network theorems. Concepts of flux, mmf, reluctance, Magnetic calculations for conductors of different configuration e.g. straight, circular, solenoidal, etc. Electromagnetic induction, self and mutual induction. Instantaneous, peak, R.M.S. and average values of alternating waves, Representation of sinusoidal wave form, simple series and parallel AC Circuits consisting of R.L. 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.
3. Fundamentals of Electronics Engineering: Semiconductor Diode, PN junction, basic principles of operation and VI characteristics of PN junction diode, static and dynamic resistance of a diode. Applications of Diode Use of a diode in rectifiers, half wave, full wave and bridge

rectifier with shunt capacitor filter, series inductor filter, zener diode and its applications, as a voltage regulator, light emitting diode (LED), Transistor: Introduction to a transistor, working of a PNP and NPN transistor, input and output characteristics, transistor configurations. Digital Electronics: Number System. Binary addition, subtraction, multiplication and division including binary points. Logic Gates and Families a) Concept of negative and positive logic, Definition, symbols and truth tables of gates. Construction of NOT, AND and OR gates from NAND and NOR gates (universal gates). Logic Simplification, Postulates of Boolean algebra, DeMorgan's Theorems.

4. Unit and Measurement: Definition, Classification, Fundamental and derived units, systems of units: FPS, CGS, MKS, Unit of physical quantities, symbols, Conversion factors, Measurements of mechanical quantities, electrical quantities. ork Power and Energy: Definition, Work and its units, Measurements of Work, Work done on bodies moving on horizontal and inclined planes (Consider frictional forces also) Concept of Power and its units, Calculations of Power (Simple cases).
5. Measurement and measuring instruments: Measurement of power (1phase 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 Generator, CT, PT and their uses.
6. Basic biology (Class 11-12 level), human anatomy and physiology, animal cell, digestive system, urinary system, respiratory system, circulatory system, skeletal system, nervous system, skin, sense organs, muscular system, food and nutrition, plant cell and photosynthesis.

- **Metallurgical & Materials Engineering**

1. Welding: Type of welding (Arc welding & gas welding), TIG & MIG welding, Brazing and soldering, welding defects, maintenance of tools and machines

2. Machining: Basic principles of turning, description and specification of lathe machine, operations and maintenance of lathe. Metal cutting principles, cutting tool, basic principles of machining with milling and drilling, shaping machine, grinding etc., machining tool, maintenance of machines.

3. Foundry: Basic knowledge on moulding and core making and casting, gating system, defects, furnaces, equipment and tools – handling and maintenance

4. Metallurgy/Testing: Metallography – sample preparation, Hardness-various types, Tensile and Compression testing – operation and maintenance, process metallurgy, corrosion.

- **Mining Engineering**

1. 1. Computer Awareness: Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc. Internet, Basic Software's knowledge and Computer applications in Mining.

2. Unit and Measurement: Definition, Classification, Fundamental and derived units, systems of units: FPS, CGS, MKS, Unit of physical quantities, symbols, Conversion factors, Measurements of mechanical quantities, electrical quantities.

3. Basic Knowledge of Mining Engineering: Principles of survey and its type, Compass survey, Types of Levelling, Introduction to GPS system. Definition and application of Remote sensing, Theories of Coal Classification of Coal, Different types of Mining Methods, Mine Atmosphere, Mine Gases, Flame Safety Lamp, Different types of Mining Machinery uses in Mine, Theory of rock drilling, different types of drilling, Explosive, Detonators, Safety fuse, Detonation cord, Detonating relay, Non-electric initiation system, Electronic detonators, Underground blasting terminology, mode of access; Crosscuts, Levels, Raises, Winzes, Ore passes, Rock properties, Physio-mechanical properties of rock, Mine fires, control of fires and fires extinguishers, Types of support systems, Withdrawal of supports, Roof bolting, roof stitching, Hydraulic support etc.

- **Physics**

Physics: Units and Dimensions with Dimensional analysis and their Limitation, Motion in one and two dimensions and Newton's Laws of Motion. Work and Energy and Conservation Laws of energy, Properties of matter i.e. Elasticity, Surface tension and viscosity in fluent motion, waves and vibration. Characteristics of waves and Simple Harmonic Motion, Rotational Motion, Conservation on angular momentum, Gravitation, Newton's law of gravitation, Kepler's law and Satellite, Heat and temperature. Measurement of temperature and mode of transfer of hear and their laws, geometric optics and simple optical instruments, Simple Law of electrostatics and their use to find the E and potential. Capacitors and dielectric constant, Laser, its principle and use, Superconductivity, Conventional and Non-Conventional energy sources.

I. Application of Computer Software like MS-Word, Excel, Power Point, Tally etc. used in day-to-day office work.
II. Internet, e-mail and various online tools used in day-to-day office work.
III. Trouble shooting of various lab equipment used in Physics Department.

- **Production and Industrial engineering**

I. Domain practical knowledge in relevant area, specific to laboratory and workshop equipment generally available in production and industrial engineering department.

II. Basics of Machine Design, Kinematics and Dynamics of Machinery, Metallurgy and Heat Treatment ,Industrial Engineering And Management, Computer Applications, Tool Design, Reliability, Maintenance and Safety Engineering

- **Centre for Computing and Networking**

1. Computer Organization and Architecture Binary representation, registers, Instruction set, timing and control, CPU, instruction cycle, addressing modes, CISC, RISC, synchronization, interrupt and exception, privileged and non-privileged instruction, hierarchical memory organization, memory mapping, cache memory, coherence, consistency, virtual memory, interleaving, DMA, Signed number, fixed and floating point numbers, control unit design, arithmetic and instruction pipelining: throughput, speedup, branch prediction, hazards

2. Programming, Data Structures, Algorithms, and Theory of Computation Programming in C, pointers, basic data structures, array, string, stack, queue, recursion, linear and non-linear data structures, searching and sorting algorithms, complexity and asymptotic analysis, Mealy and Moore machine, finite automata, Determinism and non-determinism, Regular expressions, minimization of deterministic finite automata PDA, regular grammar, CFG, Chomsky's hierarchy, closure properties, pumping lemma, Turing machine, halting problem

3. Operating System and Database Systems Basics of Popular Operating Systems (Linux & Wndows), File and Directory Management, purpose of database system, Data Models, ER-Model, Introduction to UML, keys, integrity rules, Relational Database design, Normalization, Selection and projection, Joins, SQL: data definition, aggregate function, Null Values, nested sub queries, joined relations, ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods
4. Computer Networks and Web technologies Basic of Computer networks; LAN, WAN, OSI reference model, TCP/IP, sliding window protocol, Channel allocations problem, Ethernet, Wireless LAN, Broadband Wireless, routing algorithms, Congestion control algorithms, IPv4 and IPv6, Quality of Service, UDP and TCP, Domain name system, electronic mail, World Wide
5. Web: architectural overview, dynamic web document and http, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet, Concept of Internet, Applications of Internet, Search Engines

Humanities & Social Sciences / Business Administration/Computer Applications

1. Computer Organization and Architecture Binary representation, registers, Instruction set, timing and control, CPU, instruction cycle, addressing modes, CISC, RISC, synchronization, interrupt and exception, privileged and non-privileged instruction, hierarchical memory organization, memory mapping, cache memory, coherence, consistency, virtual memory, interleaving, DMA, Signed number, fixed and floating point numbers, control unit design, arithmetic and instruction pipelining: throughput, speedup, branch prediction, hazards
2. Programming, Data Structures, Algorithms, and Theory of Computation Programming in C, pointers, basic data structures, array, string, stack, queue, recursion, linear and non-linear data structures, searching and sorting algorithms, complexity and asymptotic analysis, Mealy and Moore machine, finite automata, Determinism and non- determinism, Regular expressions, minimization of deterministic finite automata PDA, regular grammar, CFG, Chomsky's hierarchy, closure properties, pumping lemma, Turing machine, halting problem
3. Operating System and Database Systems Basics of Popular Operating Systems (Linux & Wndows), File and Directory Management, purpose of database system, Data Models, ER-Model, Introduction to UML, keys, integrity rules, Relational Database design, Normalization, Selection and projection, Joins, SQL: data definition, aggregate function, Null Values, nested sub queries, joined relations, ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods
4. Computer Networks and Web technologies Basic of Computer networks; LAN, WAN, OSI reference model, TCP/IP, sliding window protocol, Channel allocations problem, Ethernet, Wireless LAN, Broadband Wireless, routing algorithms, Congestion control algorithms, IPv4 and IPv6, Quality of Service, UDP and TCP, Domain name system, electronic mail, World Wide
5. Web: architectural overview, dynamic web document and http, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet, Concept of Internet, Applications of Internet, Search Engines
6. Computer Organization and Architecture Binary representation, registers, Instruction set, timing and control, CPU, instruction cycle, addressing modes, CISC, RISC, synchronization, interrupt and exception, privileged and non-privileged instruction, hierarchical memory organization, memory mapping, cache memory, coherence, consistency, virtual memory, interleaving, DMA, Signed number, fixed and floating point numbers, control unit design, arithmetic and instruction

pipelining: throughput, speedup, branch prediction, hazards

7. Programming, Data Structures, Algorithms, and Theory of Computation Programming in C, pointers, basic data structures, array, string, stack, queue, recursion, linear and non-linear data structures, searching and sorting algorithms, complexity and asymptotic analysis, Mealy and Moore machine, finite automata, Determinism and non- determinism, Regular expressions, minimization of deterministic finite automata PDA, regular grammar, CFG, Chomsky's hierarchy, closure properties, pumping lemma, Turing machine, halting problem

8. Operating System and Database Systems Basics of Popular Operating Systems (Linux & Wndows), File and Directory Management, purpose of database system, Data Models, ER-Model, Introduction to UML, keys, integrity rules, Relational Database design, Normalization, Selection and projection, Joins, SQL: data definition, aggregate function, Null Values, nested sub queries, joined relations, ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods

9. Computer Networks and Web technologies Basic of Computer networks; LAN, WAN, OSI reference model, TCP/IP, sliding window protocol, Channel allocations problem, Ethernet, Wireless LAN, Broadband Wireless, routing algorithms, Congestion control algorithms, IPv4 and IPv6, Quality of Service, UDP and TCP, Domain name system, electronic mail, World Wide

10. Web: architectural overview, dynamic web document and http, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet, Concept of Internet, Applications of Internet, Search Engines

4. **Senior Assistant**

General Awareness: Includes questions relating to History, Indian Polity & Constitution, Art & Culture, Geography, Economics, General Policy, Science & Scientific Research, National/International Organizations /Institutions, current events, environment etc.

Reasoning: Includes questions relating to both verbal and non-verbal types, analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc.

Mathematics: Includes questions relating to Simplification, Decimals, Fractions, L.C.M., H.C.F., Ratio & Proportion, Percentage, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Time & Work, Time & Distance, Tables & Graphs, etc.

Test of English or Hindi: In addition to the testing of candidate's understanding of the English or Hindi Languages, it's Vocabulary, Grammar, Sentence Structure, Synonyms, Antonyms and its correct usage etc. would also be tested.

Computer Awareness: Includes questions on Operating System, MS Office, MS Word, MS Excel, Power Point, Tally, Internet, E-mail, Antivirus and various online tools used in day- to-day office work.

General Administration: Constitution of India, CCS Leave Rules, CCS Conduct Rules, LTC Rules, TA/DA Rules and other Allowances, Office Procedure, Probation, Confirmation, Resignation, General Financial Rules-2017 & 2022, GeM Rules, Medical Attendance Rules & CGHS, etc.

5. Stenographer

General Awareness: Includes questions relating to History, Indian Polity & Constitution, Art & Culture, Geography, Economics, General Policy, Science & Scientific Research, National/International Organizations /Institutions, current events, environment etc.
Reasoning: Includes questions relating to both verbal and non-verbal types, analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc.
Quantitative Aptitude: Includes questions relating to Simplification, Decimals, Fractions, L.C.M., H.C.F., Ratio & Proportion, Percentage, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Time & Work, Time & Distance, Tables & Graphs, etc.
Test of English or Hindi: In addition to the testing of candidate's understanding of the English or Hindi Languages, it's Vocabulary, Grammar, Sentence Structure, Synonyms, Antonyms and its correct usage etc. would also be tested.
Computer Awareness: Includes questions on Operating System, MS Office, MS Word, MS Excel, Power Point, Tally, Internet, E-mail, Antivirus and various online tools used in day- to-day office work.

6. Senior Stenographer

General Awareness: Includes questions relating to History, Indian Polity & Constitution, Art & Culture, Geography, Economics, General Policy, Science & Scientific Research, National/International Organizations /Institutions, current events, environment etc.
Reasoning: Includes questions relating to both verbal and non-verbal types, analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc.
Quantitative Aptitude: Includes questions relating to Simplification, Decimals, Fractions, L.C.M., H.C.F., Ratio & Proportion, Percentage, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Time & Work, Time & Distance, Tables & Graphs, etc.
Test of English or Hindi: In addition to the testing of candidate's understanding of the English or Hindi Languages, it's Vocabulary, Grammar, Sentence Structure, Synonyms, Antonyms and its correct usage etc. would also be tested.
Computer Awareness: Includes questions on Operating System, MS Office, MS Word, MS Excel, Power Point, Tally, Internet, E-mail, Antivirus and various online tools used in day- to-day office work.

7. Superintendent/Personal Assistant

General Awareness: Includes questions relating to History, Indian Polity & Constitution, Art & Culture, Geography, Economics, General Policy, Science & Scientific Research, National/International Organizations /Institutions, current events, environment etc.

Reasoning: Includes questions relating to both verbal and non-verbal types, analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc.

Mathematics- Includes questions relating to Simplification, Decimals, Fractions, L.C.M., H.C.F., Ratio & Proportion, Percentage, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Time & Work, Time & Distance, Tables & Graphs, etc.

Test of English or Hindi: In addition to the testing of candidate's understanding of the English or Hindi Languages, it's Vocabulary, Grammar, Sentence Structure, Synonyms, Antonyms and its correct usage etc. would also be tested.

Computer Awareness: Includes questions on Operating System, MS Office, MS Word, MS Excel, Power Point, Tally, Internet, E-mail, Antivirus and various online tools used in day- to-day office work.

General Administration: Constitution of India, FR & SR, CCS Leave Rules, CCS Conduct Rules, CCS Pension Rules, New Pension Scheme, Disciplinary & Vigilance, LTC Rules, TA/DA Rules and other Allowances, GPF Rules, Office Procedure, Reservation & Concession in Services, Deputation, Foreign Service, Lien, Probation, Confirmation, Retirement, Resignation, DPC, LDE, Seniority, General Financial Rules-2017 & 2022, GeM Rules, Delegation of Financial Power Rules, Budgeting & Internal Audit, HEFA/ PFMS, Medical Attendance Rules & CGHS, etc.

8. Senior Technician

PART A

General Awareness: Includes questions relating to History, Indian Polity & Constitution, Art & Culture, Geography, Economics, General Policy, Science & Scientific Research, National/International Organizations /Institutions, current events, environment etc.

Reasoning: Includes questions relating to both verbal and non-verbal types, analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc.

Mathematics: Includes questions relating to Simplification, Decimals, Fractions, L.C.M., H.C.F., Ratio & Proportion, Percentage, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Time & Work, Time & Distance, Tables & Graphs, etc.

Test of English or Hindi: In addition to the testing of candidate's understanding of the English or Hindi Languages, it's Vocabulary, Grammar, Sentence Structure, Synonyms, Antonyms and its correct usage etc. would also be tested.

Computer Awareness: Includes questions on Operating System, MS Office, MS Word, MS Excel, Power Point, Tally, Internet, E-mail, Antivirus and various online tools used in day- to-day office work.

PART B

- **Civil**

Computer awareness : Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc. Internet, MS-DOS, Data Entry, Softwares knowledge, applications of computers in civil engineering

Surveying: Introduction, History and principles of chain survey. Classification, accuracy, types of chains and tapes. Direct and Indirect ranging.

Compass survey: Instrument and its setting up, Bearing and each included angle of close traverse. Local attraction. Magnetic declination and its true bearing. Precaution in using prismatic compass.

Levelling: Auto level, dumpy Level, Tilting Level - introduction, definition · Principle of levelling. Levelling staffs, its graduation & types. Temporary and permanent adjustment, procedure in setting up. Level & horizontal surface. Datum Benchmark, Focusing & parallax Deduction of levels / Reduced Level. Types of leveling, Application to chain and Levelling Instrument to Building construction. Reciprocal levelling.

Contouring: Definition, Characteristics, Methods. Direct and Indirect methods · Interpolation of Contour, Contour gradient, Uses of Contour plan and Map. Application of contouring for road project.

Theodolite survey: Introduction. Types of theodolite. Uses, Methods of Plotting. Transit vernier theodolite. Terms of transit theodolite. Fundamental line of theodolite. Adjustment of theodolite.

Total Station: Introduction. Components parts, accessories used.

GPS (Global Positioning System): Introduction of GPS system. Definition and application of Remote sensing.

Water supply: Introduction. Terms used in PHE. Various types of water supply pipes and fittings. Material specification. Type of overhead and

underground water tanks. Tools and equipment's used in water supply system. Basic concept, terminology and process used in Water treatment plant ·

Systems of sanitation: System of house drainage, plumbing, sanitary fittings, etc. Types of sewer appurtenance, Systems of plumbing. Type of sewage disposals. Manholes, soak pit & Septic tank. Basic concept, terminology and process used in Sewerage treatment plant.

- **Electrical**

Mathematics: Arithmetic, Geometric and Harmonic Progressions, Binomial expansion, Matrices, Elementary operations, Rank of a matrix Parabola, Ellipse and Hyperbola, Differentiation of a function, implicit function, parametric function. Successive differentiation. Maxima and Minima, Partial Differentiation, Definite and indefinite Integration. First order and first degree ordinary differential equations. **Physics:** Units and Dimensions with Dimensional analysis and their Limitation, Motion in one and two dimensions and Newton's Laws of Motion. Work and Energy and Conservation Laws of energy, Properties of matter i.e. Elasticity, Surface tension and viscosity in fluent motion, waves and vibration. Characteristics of waves and Simple Harmonic Motion, Rotational Motion, Conservation on angular momentum, Gravitation, Newton's law of gravitation, Kepler's law and Satellite, Heat and temperature. Measurement of temperature and mode of transfer of hear and their laws, geometric optics and simple optical instruments, Simple Law of electrostatics and their use to find the E and potential. Capacitors and dielectric constant, Laser, its principle and use, Superconductivity, Conventional and Non-Conventional energy sources.

Elements of Electrical Engineering:

Electrical and Magnetic circuits, EMF, Kirchhoff's law and Faraday's Laws, Network Theorems, AC circuit, RMS value

Behavior of RIC elements, Series and parallel circuits, series and parallel resonance circuits, Transformers, Introduction to single phase and three phase transformers DC Machines, Theory, Constructions and Operation of three phase induction motors, Transmission and Distribution

Advantages of high voltages for transmission, Comparison of 3 phase, single phase, 2 Phase and three wire D.C. Systems.

Elements of Electronic Engineering:

Measurements & Instrumentations, Errors, standards, accuracy precision resolution, Ammeters, Voltmeters, watt meters

Energy meters, insulation tester, multimeter, CRO, measurement of V, I & F on CRO low, medium & high resistance measurement, AC bridges

Transducers for measurement of temperature, displacement, communication system, types of modulation, demodulation, Analog Electronics

Semiconductor diode circuits, zener diode and zener diode circuits, LED, photo diode, BJT, FET & their configurations and characteristics

Biasing, small signal and Large signal amplifier, OP-AMPS, oscillators, regulated power supply.

COMPUTER LITERACY: Characteristics of Computer, Computer Organization, Input/output Devices, Computer Software-Relationship between Hardware and Software, Operating Systems, MS-Office (exposure of Word, Excel/spread sheet, Power point). Digital Signature, Application of information technology in Government for e-Governance, mobile/Smartphone, Information tasks.

○ Architecture

Section 1: Architecture and Design

Visual composition in 2D and 3D; Principles of Art and Architecture; Organization of space; Architectural Graphics; Anthropometrics; Planning and design considerations for different building types; Site planning; Circulation- horizontal and vertical; Barrier free design; Space Standards; Building Codes; National Building Code.

Elements, construction, architectural styles and examples of different periods of Indian and Western History of Architecture; Vernacular and Traditional architecture.

Section 2: Computer awareness

Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc. Internet, MS-DOS, Data Entry, Softwares knowledge, applications of computers in civil engineering; Computer Graphics – concepts of CAD, BIM, 3D modeling and Architectural rendition.

Section 3: Building Materials, Construction

Behavioral characteristics and applications of different building materials viz. mud, timber, bamboo, brick, concrete, steel, glass, FRP, AAC, different polymers, composites.

Building construction techniques, methods and details; Building systems and prefabrication of building elements; Principles of Modular Coordination; Estimation, specification, valuation, professional practice; Construction planning and equipment.

Section 4: Building and Structures

Principles of strength of materials; Design of structural elements in wood, steel and RCC; Elastic and Limit State design; Structural systems in RCC and Steel; Form and Structure; Principles of Prestressing; High Rise and Long Span structures; Principles and design of disaster resistant structures.

Section 5: Environmental Design

Ecosystem - natural and man-made ecosystem; Ecological principles; Concepts of Environmental Impact Analysis; Environmental considerations in planning and design; Thermal comfort, ventilation and air movement; Principles of lighting and illumination; Climate responsive design; Solar architecture; Principles of architectural acoustics; Green Building - Concepts and Rating; ECBC; Building Performance Simulation and Evaluation.

Section 6: Site Planning and Landscape

Site planning; Landscape design; Development controls – FAR, densities and building byelaws.

Section 7: Building Services

Building Services: Water supply; Principles of water supply and sanitation systems; water treatment; Water supply and distribution system; Water harvesting systems; Principles, Planning and Design of storm water drainage system.

Sewerage and drainage systems; Sewage disposal methods; Sanitary fittings and fixtures; Plumbing systems; Principles of internal and external drainage system.

Electrical system; Principles of electrification of buildings; Power Supply and Communication Systems.

Air -Conditioning systems; Firefighting Systems; Building Safety and Security systems.

Solid waste management; Methods of solid waste management - collection, transportation and disposal; Recycling and Reuse of solid waste.

Intelligent Buildings; Elevators and Escalators.

- **Mechanical**

Computer awareness: Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc. Internet, MS-DOS, Data Entry, Softwares knowledge, applications of computers in mechanical engineering
Automobile Engineering: Automobile and its development, Classification of automobiles, Transmission System, Steering System, Braking System, Dynamo and Alternator and Exhaust Emissions
Computer Integrated Manufacturing: Introduction to NC, CNC & DNC, Construction and Tooling, Part Programming, System Devices, Problems in CNC Machines, Automation and NC system
Engineering Materials: Scope of Material Science, Crystallography, Metals and Alloys, Heat Treatment, Plastics and Advanced Materials
Engineering Mechanics: Laws of Forces, Moment, Friction, Centre of Gravity and Simple Machines
Fluid Mechanics: Type and Properties of Fluids, Pressure and its Measurement, Flow of Fluids and Flow through Pipes
Heat-Transfer: Modes of Heat Transfer, Fourier's Law, Steady State Conduction, Composite Structures, Natural and Forced Convection and Thermal Radiation
I.C. Engines: Working principle of two stroke and four stroke cycle, SI engines and CI Engines, Otto cycle, Diesel cycle, Dual cycle, Fuel Supply and Ignition System in Petrol Engine, Fuel System of Diesel Engine, Cooling and Lubrication and Testing of IC Engines
Machine Design: Design-Definition, Types of design, necessity of design, Design terminology: stress, strain, factor of safety, factors affecting factor of safety, stress concentration, methods to reduce stress concentration, fatigue, endurance limit, Design Failure, Design of Shaft, Design of Key, Design of Joints, Design of Flange Coupling and Design of Screwed Joints
Machining and Machine Tool Operations: Cutting Tools and Cutting Materials, Lathe, Drilling, Boring, Shaping and Planing, Broaching, Jigs and Fixtures and Cutting Fluids and Lubricants, Welding, Pattern Making, Metal Forming Processes **Mechanics of Materials:** Stresses and Strains, Resilience, Moment of Inertia, Bending Moment and Shearing Force, Bending Stresses, Columns, Torsion and Springs
Metrology and Inspection: Linear and Angular Measurement, Measurement of Surface Finish and Measurements of Screw threads and Gauges
Refrigeration and air-conditioning: Fundamentals of Refrigeration, Vapour Compression System, Refrigerants, Air Refrigeration System, Vapour Absorption System and Refrigeration Equipment
Theory of Machines: Simple Mechanisms, Friction, Power Transmission, Flywheel, Governor and Balancing
Thermodynamics: Fundamental Concepts, Laws of Perfect Gases, Thermodynamic Processes on Gases, Laws of Thermodynamics, Ideal and Real Gases and Properties of Steam
Turbo-machinery: Introduction to Turbomachines, Classification of Turbomachines, Steam Turbines and Steam Condensers, Gas Turbines and Jet Propulsion
Vibrations: Types-Longitudinal, Transverse and Torsional vibrations, Dampening of Vibrations, Causes of vibrations in Machines, their Harmful Effects and Remedies. -ECE

- **ECE**

1. **Computer awareness:** Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc. Internet, MS-DOS, Computer Generation & Development, UNIX, Windows, Lotus, SmartSuite, Data Entry, Softwares knowledge, Networking Platforms, applications of computers in electrical engineering
2. **Basic concepts:** Concepts of resistance, inductance, capacitance, and various factors affecting them. Concepts of current, voltage, power, energy and their units., Kirchhoff 's law, Simple Circuit solution using network theorems. Concepts of flux, mmf, reluctance, Magnetic calculations for conductors of different configuration e.g. straight, circular, solenoidal, etc. Electromagnetic induction, self and mutual induction. Instantaneous, peak, R.M.S. and average values of alternating waves, Representation of sinusoidal wave form, simple series and parallel AC Circuits consisting of R.L. and C, Resonance, Tank Circuit. Poly Phasesystem – star and delta connection, 3 phase power, DC and sinusoidal response of R-Land R-C circuit.
3. **Fundamentals of Electronics Engineering:** Semiconductor Diode, PN junction, basic principles of operation and VI characteristics of PN junction diode, static and dynamic resistance of a diode. Applications of Diode Use of a diode in rectifiers, half wave, full wave and bridge rectifier with shunt capacitor filter, series inductor filter, zener diode and its applications, as a voltage regulator, light emitting diode (LED), Transistor: Introduction to a transistor, working of a PNP and NPN transistor, input and output characteristics, transistor configurations.
4. **Digital Electronics** 1. Number System. 2. Binary addition, subtraction, multiplication and division including binary points 3. Logic Gates and Families a) Concept of negative and positive logic b) Definition, symbols and truth tables of gates. Construction of NOT, AND and OR gates from NAND and NOR gates (universal gates). 5. Logic Simplification a) Postulates of Boolean algebra, DeMorgan's Theorems.
5. **Power Electronics** 1. Introduction to thyristors and other Power Electronics Devices SCR – Different methods of SCR triggering. - Different commutation circuits for SCR. - Construction & working principle of DIAC, TRIAC & their V-I characteristics 2. Controlled Rectifiers
6. **Electrical Machines:** (a): D.C. Machine – Construction, Basic Principles of D.C. motors and generators, their characteristics (b): 1 phase and 3 phase transformers – Construction, Principles of operation, equivalent circuit, Tests, Losses and efficiency. (c):3 phase induction motors, rotating magnetic field,
   principle of operation, equivalent circuit, torque-speed characteristics.
7. **Unit and Measurement**: Definition, Classification, Fundamental and derived units, systems of units: FPS, CGS, MKS, Unit of physical quantities, symbols, Conversion factors, Measurements of mechanical quantities, electrical quantities.
8. **Work Power and Energy**: Definition, Work and its units, Measurements of Work,

   Work done on bodies moving on horizontal and inclined planes (Consider frictional forces also) Concept of Power and its units, Calculations of Power (Simple cases).
9. **Measurement and measuring instruments**: Measurement of power (1phase 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 Generator, CT, PT and their uses.

10. **Sensors and Industrial Instrumentation**: Resistive Capacity, Inductive, piezometric, Half effect sensors and associated signal conditioning circuits, Transducers for industrial instrumentation, Displacement (Linear and Angular).

- **Computer Engineering**

Computer Organization and Architecture

Binary representation, registers, Instruction set, timing and control, CPU, instruction cycle, addressing modes, CISC, RISC, synchronization, interrupt and exception, privileged and non-privileged instruction, hierarchical memory organization, memory mapping, cache memory, coherence, consistency, virtual memory, interleaving, DMA, Signed number, fixed and floating point numbers, control unit design, arithmetic and instruction pipelining: throughput, speedup, branch prediction, hazards

Programming, Data Structures, Algorithms, and Theory of Computation

Programming in C, pointers, basic data structures, array, string, stack, queue, recursion, linear and non-linear data structures, searching and sorting algorithms, complexity and asymptotic analysis, Mealy and Moore machine, finite automata, Determinism and non-determinism, Regular expressions, minimization of deterministic finite automata PDA, regular grammar, CFG, Chomsky's hierarchy, closure properties, pumping lemma, Turing machine, halting problem

Operating System and Database Systems

Basics of Popular Operating Systems (Linux & Windows), File and Directory Management, purpose of database system, Data Models, ER-Model, Introduction to UML, keys, integrity rules, Relational Database design, Normalization, Selection and projection, Joins, SQL: data definition, aggregate function, Null Values, nested sub queries, joined relations, ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods **Computer Networks and Web technologies Basic of Computer networks;** LAN, WAN, OSI reference model, TCP/IP, sliding window protocol, Channel allocations problem, Ethernet, Wireless LAN, Broadband Wireless, routing algorithms, Congestion control algorithms, IPv4 and IPv6, Quality of Service, UDP and TCP, Domain name system, electronic mail, World Wide **Web:** architectural overview, dynamic web document and http, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet, Concept of Internet, Applications of Internet, Search Engines

- **Chemistry**

Some Basic Concepts of Chemistry

Importance of Chemistry, Nature of Matter, Properties of Matter and their Measurement, Uncertainty in Measurement , Laws of Chemical Combinations, Dalton’s Atomic Theory, Atomic and Molecular Masses, Mole Concept and Molar Masses, Percentage Composition, Stoichiometry and Stoichiometric Calculations **Structure of Atom**

Discovery of Sub-atomic Particles, Atomic Models, Developments Leading to the Bohr’s Model of Atom, Bohr’s Model for Hydrogen Atom, Towards Quantum Mechanical Model of the Atom, Quantum Mechanical Model of Atom

Classification of Elements and Periodicity in Properties

Why do we Need to Classify Elements ?, Genesis of Periodic Classifications, Modern Periodic Law and the Present Form of the Periodic Table, Nomenclature of Elements with Atomic Numbers > 100 , Electronic Configurations of Elements and the Periodic Table, Electronic Configurations and Types of Elements: s-, p-, d-, f- Blocks, Periodic Trends in Properties of Elements

Chemical Bonding and Molecular Structure

Kössel-Lewis Approach to Chemical Bonding, Ionic or Electrovalent Bond, Bond Parameters, The Valence Shell Electron Pair Repulsion (VSEPR) Theory, Valence Bond Theory, Hybridisation, Molecular Orbital Theory, Bonding in Some Homonuclear Diatomic Molecules , Hydrogen Bonding

Thermodynamics

Thermodynamic Terms , Applications, Measurement of ΔU and ΔH: Calorimetry, Enthalpy Change, ΔrH of a Reaction – Reaction Enthalpy, Enthalpies for Different Types of Reactions, Spontaneity, Gibbs Energy Change and Equilibrium **Equilibrium**

Equilibrium in Physical Processes, Equilibrium in Chemical Processes – Dynamic Equilibrium, Law of Chemical Equilibrium and Equilibrium Constant, Homogeneous Equilibria, Heterogeneous Equilibria, Applications of Equilibrium Constants , Relationship between Equilibrium Constant K, Reaction Quotient Q and Gibbs Energy G, Factors Affecting Equilibria, Ionic Equilibrium in Solution, Acids, Bases and Salts, Ionization of Acids and Bases, Buffer Solutions, Solubility Equilibria of Sparingly Soluble Salts

Redox Reactions

Classical Idea of Redox Reactions-Oxidation and Reduction Reactions, Redox Reactions in Terms of Electron Transfer Reactions, Oxidation Number, Redox Reactions and Electrode Processes

Organic Chemistry – Some Basic Principles and Techniques

General Introduction, Tetravalence of Carbon: Shapes of Organic Compounds, Structural Representations of Organic Compounds, Classification of Organic Compounds, Nomenclature of Organic Compounds, Isomerism, Fundamental

Concepts in Organic Reaction Mechanism, Methods of Purification of Organic Compounds, Qualitative Analysis of Organic Compounds, Quantitative Analysis **Hydrocarbons**

Classification, Alkanes, Alkenes, Alkynes, Aromatic Hydrocarbon, Carcinogenicity and Toxicity

Solutions

Types of Solutions, Expressing Concentration of Solutions, Solubility, Vapour Pressure of Liquid Solutions, Ideal and Non-ideal Solutions, Colligative Properties and Determination of Molar Mass, Abnormal Molar Masses

Electrochemistry

Electrochemical Cells, Galvanic Cells, Nernst Equation, Conductance of Electrolytic Solutions, Electrolytic Cells and Electrolysis, Batteries, Fuel Cells, Corrosion **Chemical Kinetics**

Rate of a Chemical Reaction, Factors Influencing Rate of a Reaction, Integrated Rate Equations, Temperature Dependence of the Rate of a Reaction, Collision Theory of Chemical Reactions

The d-and f-Block Elements

Position in the Periodic Table, Electronic Configurations of the d-Block Elements, General Properties of the Transition Elements (d-Block),

Some Important Compounds of Transition Elements, The Lanthanoids, The Actinoids, Some Applications

Coordination Compounds

Werner's Theory of Coordination Compounds, Definitions of Some Important Terms Pertaining to Coordination Compounds, Nomenclature of Coordination Compounds, Isomerism in Coordination Compounds, Bonding in Coordination Compounds, Bonding in Metal Carbonyls, Importance and Applications of Coordination, Compounds

Haloalkanes and Haloarenes

Classification, Nomenclature, Nature of C–X Bond, Methods of Preparation of Haloalkanes, Preparation of Haloarenes, Physical Properties, Chemical Reactions, Polyhalogen Compounds

Alcohols, Phenols and Ethers

Classification, Nomenclature, Structures of Functional Groups, Alcoho

ls and Phenols, Some Commercially Important Alcohols, Ethers

Aldehydes, Ketones and Carboxylic Acids

Nomenclature and Structure of Carbonyl Group, Preparation of Aldehydes and Ketones, Physical Properties, Chemical Reactions, Uses of Aldehydes and Ketones, Nomenclature and Structure of Carboxyl Group, Methods of Preparation of Carboxylic Acids, Physical Properties, Chemical Reactions, Uses of Carboxylic Acids **Amines**

Structure of Amines, Classification, Nomenclature, Preparation of Amines, Physical Properties, Chemical Reactions, Method of Preparation of Diazonium Salts, Physical Properties, Chemical Reactions, Importance of Diazonium Salts in Synthesis of Aromatic Compounds

Biomolecules

Carbohydrates, Proteins, Enzymes,Vitamins, Nucleic Acids, Hormones

- **Computer Application**

1. Computer Organization and Architecture Binary representation, registers, Instruction set, timing and control, CPU, instruction cycle, addressing modes, CISC, RISC, synchronization, interrupt and exception, privileged and non-privileged instruction, hierarchical memory organization, memory mapping, cache memory, coherence, consistency, virtual memory, interleaving, DMA, Signed number, fixed and floating point numbers, control unit design, arithmetic and instruction pipelining: throughput, speedup, branch prediction, hazards
2. Programming, Data Structures, Algorithms, and Theory of Computation Programming in C, pointers, basic data structures, array, string, stack, queue, recursion, linear and non-linear data structures, searching and sorting algorithms, complexity and asymptotic analysis, Mealy and Moore machine, finite automata, Determinism and non-determinism, Regular expressions, minimization of deterministic finite automata PDA, regular grammar, CFG, Chomsky's hierarchy, closure properties, pumping lemma, Turing machine, halting problem
3. Operating System and Database Systems Basics of Popular Operating Systems (Linux & Wndows), File and Directory Management, purpose of database system, Data Models, ER-Model, Introduction to UML, keys, integrity rules, Relational Database design, Normalization, Selection and projection, Joins, SQL: data definition, aggregate function, Null Values, nested sub queries, joined relations, ACID properties,

serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods

4. Computer Networks and Web technologies Basic of Computer networks; LAN, WAN, OSI reference model, TCP/IP, sliding window protocol, Channel allocations problem, Ethernet, Wireless LAN, Broadband Wireless, routing algorithms, Congestion control algorithms, IPv4 and IPv6, Quality of Service, UDP and TCP, Domain name system, electronic mail, World Wide
5. Web: architectural overview, dynamic web document and http, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet, Concept of Internet, Applications of Internet, Search Engines

- **Information Technology**

1. **Hardware**
   Assembling of PC, Installation of Systems and troubleshooting, BIOS settings, Installation and testing of a printer, Printer Maintenance, Scanner Installation, Webcam Installation, making various types of cables for networking, Installation and Maintenance of UPS Systems, Installation and maintenance of various networking devices like Router, Switches, Laying out Structured cabling, Installation of Firewalls and Connectivity of LAN & WAN, Installation of Wireless network devices.
2. **Software**
   Debugging C/ C++/ Python Programs, Installation and Administration of Oracle & My SQL, Installation of various variants of operating systems like Windows and Linux, Application & Troubleshooting, Upgrading OS, Backup, format & restore OS, Installation of Software like Visual Studio, UML, Cisco Packet tracer, Working of MS-Office components like Word, Excel & PowerPoint, Configuring and sharing internet in PCs and other devices, Configuring firewalls &Usage of access lists, Working with Wireless Networks (Installation & Configuration), Designing webpages using HTML, CSS, Java Script, Designing and maintain Static and Dynamic Websites.
3. **Programming and Data Structure**
   C Language, Object oriented Programming, Functions, Data type, Recursion, Arrays, Stacks, Queues, Searching and Sorting algorithms.

- **Central Workshop**

1. Computer awareness: Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc. Internet, MS-DOS, Data Entry, Softwares knowledge, applications of computers in mechanical engineering
2. Welding Type of welding (Arc welding & gas welding), TIG & MiG welding, Brazing and soldering, welding defects, maintenance of tools and machines
3. Turning Basic principle of turning, description and specification of lathe machine, operations of lathe e.g. turning, taper turning, kurling, thread cutting etc., maintenance of lathe.
4. Machining Metal cutting principles, cutting tool, basic principles of machining with milling and drilling, shaping machine, grinding etc., machining tool, maintenance of machines.
5. Fitting Functions and working of fitting tools such as files, chisels, scrapers, try squares etc., maintenance of all tools.

6. CNC Operation Components and function of CNC operation, handling of CNC machines, ro
7. Metrology and Inspection Linear and Angular Measurement, Measurement of Surface Finish and Measurements of Screw threads and Gauges
8. Mechanics of Materials Stresses and Strains, Resilience, Moment of Inertia, Bending Moment and Shearing Force, Bending Stresses, Columns, Torsion and Springs
9. Engineering Materials Scope of Material Science, Crystallography, Metals and Alloys, Heat Treatment, Plastics and Advanced Materials
10. Engineering Mechanics Laws of Forces, Moment, Friction, Centre of Gravity and Simple Machines

- **Centre for Computing and Networking**

1. Computer Organization and Architecture Binary representation, registers, Instruction set, timing and control, CPU, instruction cycle, addressing modes, CISC, RISC, synchronization, interrupt and exception, privileged and non-privileged instruction, hierarchical memory organization, memory mapping, cache memory, coherence, consistency, virtual memory, interleaving, DMA, Signed number, fixed and floating point numbers, control unit design, arithmetic and instruction pipelining: throughput, speedup, branch prediction, hazards
2. Programming, Data Structures, Algorithms, and Theory of Computation Programming in C, pointers, basic data structures, array, string, stack, queue, recursion, linear and non-linear data structures, searching and sorting algorithms, complexity and asymptotic analysis, Mealy and Moore machine, finite automata, Determinism and non-determinism, Regular expressions, minimization of deterministic finite automata PDA, regular grammar, CFG, Chomsky's hierarchy, closure properties, pumping lemma, Turing machine, halting problem
3. Operating System and Database Systems Basics of Popular Operating Systems (Linux & Wndows), File and Directory Management, purpose of database system, Data Models, ER-Model, Introduction to UML, keys, integrity rules, Relational Database design, Normalization, Selection and projection, Joins, SQL: data definition, aggregate function, Null Values, nested sub queries, joined relations, ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods
4. Computer Networks and Web technologies Basic of Computer networks; LAN, WAN, OSI reference model, TCP/IP, sliding window protocol, Channel allocations problem, Ethernet, Wireless LAN, Broadband Wireless, routing algorithms, Congestion control algorithms, IPv4 and IPv6, Quality of Service, UDP and TCP, Domain name system, electronic mail, World Wide
5. Web: architectural overview, dynamic web document and http, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet, Concept of Internet, Applications of Internet, Search Engines

- **Bio Technology**

1. **Concepts of Biotechnology:** Technology and Applications of Biotechnology, Biomolecules: Structure, function and application of monomeric and polymeric carbohydrate, protein, lipids and nucleic acid;

Multiple Alleles, Linkage and Crossing Over, Genetic Mapping, DNA Replication, Transcription, Translation, Mutations, Human Genetic Disorders. Cell Structure and Components, Cell Division, Cell Cycle, Cell Communication, Nutrition, Reproduction, host immune responses, Tool and technology of rDNA technology, Polymerase chain reaction (PCR), Hybridization techniques, DNA library, DNA sequencing, Site-directed mutagenesis and protein engineering, comparative genomics, Functional genomics, Proteomics, Tools and techniques in Bioinformatics, Microbial culture techniques, Measurement and kinetics of microbial growth, Scale up of microbial process, Isolation of microbial products, Strain isolation and improvement, Applications of microbial culture technology, Biosafety issues in microbial technology, Cell and tissue culture techniques, Applications of cell and tissue culture, Gene transfer methods in plants, Transgenic plants with beneficial traits, Biosafety in plant genetic engineering, Animal cell culture techniques, Characterisation of cell lines, Methods of gene delivery into cells, Scale-up of animal culture process, Applications of animal cell culture, Stem cell technology, Tissue engineering

2. **Concepts of Chemistry:** Nature of matter, laws of chemical combination, Dalton's atomic theory: concept of elements, atoms and molecules, empirical and molecular formula, chemical reactions, stoichiometry and calculations based on stoichiometry, isotopes and isobars, Rutherford's model and its limitations, Bohr's model and its limitations, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, Aufbau principle, Pauli's exclusion principle and Hund's rule, periodic table and the present form of periodic table, periodic trends in properties of elements, Lewis's structure, valence bond theory, resonance, VSEPR theory, molecular orbital theory, Concepts of System and types of systems, surroundings, work, heat, energy, Laws of thermodynamics concept, mathematical expression and application, Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of mass action, equilibrium constant, factors affecting equilibrium, Le Chatelier's principle, ionization of acids and bases, concept of pH, buffer solution, Henderson Equation, Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions, applications of redox reactions, qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds, Physical, chemical properties of organic compound, Major Reaction associated with organic compounds (aliphatic and aromatic) Carcinogenicity and toxicity

3. **Concepts of Physics:** Units of measurement; systems of units; SI units, fundamental and derived units, Dimensions of physical quantities, dimensional analysis and its applications, Scalar and vector quantities, kinetic energy, work energy theorem, power, Elasticity, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear modulus of rigidity, Poisson's ratio, Pascal's law and its applications Stokes' law, Bernoulli's theorem and its simple applications. Surface energy and surface tension, specific heat capacity; Cp, Cv - calorimetry; latent heat capacity, conduction, convection and radiation, thermal conductivity, Kinetic theory of gases, Avogadro's number, Electric charges, Conservation of charge, Coulomb's law, Electric flux, statement of Gauss's theorem and its applications, Electric potential, potential difference, Conductors and insulators, free charges and bound charges

inside a conductor, Dielectrics and electric polarization, capacitors and capacitance, combination of capacitors in series and in parallel, energy stored in a capacitor, Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current; Ohm's law, V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity, potential difference and emf of a cell, combination of cells in series and in parallel, Kirchhoff's rules, Wheatstone bridge, Concept of magnetic field, Ampere's law and its applications, Bar magnet, bar magnet as an equivalent solenoid , magnetic field intensity due to a magnetic dipole, torque on a magnetic dipole, magnetic field lines, Para, dia and ferro, magnetic substances with examples and properties, Magnetization of materials, effect of temperature on magnetic properties, Electromagnetic induction; Faraday's laws, induced EMF and current; resonance, Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, X-rays, gamma rays) and their uses, Microscopes and their magnifying powers, Energy bands in conductors, semiconductors and insulators , Intrinsic and extrinsic semiconductors- p and n type, p-n junction, Semiconductor diode - I-V characteristics in forward and reverse bias, application of junction diode -diode as a rectifier

4. **Concepts of Mathematics:** Continuity and Differentiability, Applications of Derivatives, Integrals and Applications of the Integrals, Differential Equations, Vectors and Three-Dimensional Geometry, Linear Programming and probability.

- **Chemical Engineering**

1. Distance and displacement, Scalar and Vector quantities, Speed and velocity, motion, mass and weight, momentum, impulse, laws of motion, conservation of momentum, work, power and energy, conservation of energy, laws of reflection and refraction, refraction through a glass slab and prism, Ohm’s law, Law of resistance in series and parallel, electric power.

2. Atomic and molecular mass, mole concept, Avogadro’s Number, Avogadro’s law, ideal gas, gas laws, diffusion, isotopes and isobars in an atom, Postulates of Bohr’s theory, Periodic classification of elements and gradation of properties, electrovalent, covalent and co-ordinate bonds, Chemical Kinetics, Electrochemistry, Surface Chemistry, Phase Rule, Distribution Law, True solution, colloids and suspension, strong and weak electrolytes. Acids, bases and salts, pH of a solution, Rate of the reaction and factors affecting the rate of the reaction, Oxidation and reduction, IUPAC Nomenclature, Aliphatic compounds, Aromatic compound, Carbohydrates and Polymers.

3. Introduction and concepts of Mechanical Operations, particulate solids, Screen Analysis, Size Reduction, Sedimentation, Filtration.

4. General Introduction & Concept of Safety, Chemical & Fire Hazards & their Control, Other hazards & occupational diseases, Personal Protective Devices, Introduction to pollution, Air Pollution, Water pollution, Solid waste disposal.

5. Steady State Heat Transfer by conduction, Convection and Radiation, Heat Exchangers, Evaporation, diffusion, absorption, distillation, Humidification and Dehumidification, Drying, Leaching, Extraction

- **Bio Medical Engineering**

1. Computer awareness: Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc.
2. Basic concepts: Concepts of resistance, inductance, capacitance, and various factors affecting them. Concepts of current, voltage, power, energy and their units., Kirchhoff 's law, Simple Circuit solution using network theorems. Concepts of flux, mmf, reluctance, Magnetic calculations for conductors of different configuration e.g. straight, circular, solenoidal, etc. Electromagnetic induction, self and mutual induction. Instantaneous, peak, R.M.S. and average values of alternating waves, Representation of sinusoidal wave form, simple series and parallel AC Circuits consisting of R.L. 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.
3. Fundamentals of Electronics Engineering: Semiconductor Diode, PN junction, basic principles of operation and VI characteristics of PN junction diode, static and dynamic resistance of a diode. Applications of Diode Use of a diode in rectifiers, half wave, full wave and bridge rectifier with shunt capacitor filter, series inductor filter, zener diode and its applications, as a voltage regulator, light emitting diode (LED), Transistor: Introduction to a transistor, working of a PNP and NPN transistor, input and output characteristics, transistor configurations. Digital Electronics: Number System. Binary addition, subtraction, multiplication and division including binary points. Logic Gates and Families a) Concept of negative and positive logic, Definition, symbols and truth tables of gates. Construction of NOT, AND and OR gates from NAND and NOR gates (universal gates). Logic Simplification, Postulates of Boolean algebra, DeMorgan's Theorems.
4. Unit and Measurement: Definition, Classification, Fundamental and derived units, systems of units: FPS, CGS, MKS, Unit of physical quantities, symbols, Conversion factors, Measurements of mechanical quantities, electrical quantities. ork Power and Energy: Definition, Work and its units, Measurements of Work, Work done on bodies moving on horizontal and inclined planes (Consider frictional forces also) Concept of Power and its units, Calculations of Power (Simple cases).
5. Measurement and measuring instruments: Measurement of power (1phase 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 Generator, CT, PT and their uses.
6. Basic biology (Class 11-12 level), human anatomy and physiology, animal cell, digestive system, urinary system, respiratory system, circulatory system, skeletal system, nervous system, skin, sense organs, muscular system, food and nutrition, plant cell and photosynthesis.

- **Metallurgical & Materials Engineering**

1. Welding: Type of welding (Arc welding & gas welding), TIG & MIG welding, Brazing and soldering, welding defects, maintenance of tools and machines

2. Machining: Basic principles of turning, description and specification of lathe machine, operations and maintenance of lathe. Metal cutting principles, cutting tool, basic principles of machining with milling and drilling, shaping machine, grinding etc., machining tool, maintenance of machines.

3. Foundry: Basic knowledge on moulding and core making and casting, gating system, defects, furnaces, equipment and tools – handling and maintenance

4. Metallurgy/Testing: Metallography – sample preparation, Hardness-various types, Tensile and Compression testing – operation and maintenance, process metallurgy, corrosion.

- **Mining Engineering**

1. Computer Awareness: Basic knowledge of Computer Applications, viz; MS Word, MS Excel, Power Point etc. Internet, Basic Software's knowledge and Computer applications in Mining.

2. Unit and Measurement: Definition, Classification, Fundamental and derived units, systems of units: FPS, CGS, MKS, Unit of physical quantities, symbols, Conversion factors, Measurements of mechanical quantities, electrical quantities.

3. Basic Knowledge of Mining Engineering: Principles of survey and its type, Compass survey, Types of Levelling, Introduction to GPS system. Definition and application of Remote sensing, Theories of Coal Classification of Coal, Different types of Mining Methods, Mine Atmosphere, Mine Gases, Flame Safety Lamp, Different types of Mining Machinery uses in Mine, Theory of rock drilling, different types of drilling, Explosive, Detonators, Safety fuse, Detonation cord, Detonating relay, Non-electric initiation system, Electronic detonators, Underground blasting terminology, mode of access; Crosscuts, Levels, Raises, Winzes, Ore passes, Rock properties, Physio-mechanical properties of rock, Mine fires, control of fires and fires extinguishers, Types of support systems, Withdrawal of supports, Roof bolting, roof stitching, Hydraulic support etc.

- **Physics**

Physics: Units and Dimensions with Dimensional analysis and their Limitation, Motion in one and two dimensions and Newton's Laws of Motion. Work and Energy and Conservation Laws of energy, Properties of matter i.e. Elasticity, Surface tension and viscosity in fluent motion, waves and vibration. Characteristics of waves and Simple Harmonic Motion, Rotational Motion, Conservation on angular momentum, Gravitation, Newton's law of gravitation, Kepler's law and Satellite, Heat and temperature. Measurement of temperature and mode of transfer of hear and their laws, geometric optics and simple optical instruments, Simple Law of electrostatics and their use to find the E and potential. Capacitors and dielectric constant, Laser, its

principle and use, Superconductivity, Conventional and Non-Conventional energy sources.

IV. Application of Computer Software like MS-Word, Excel, Power Point, Tally etc. used in day-to-day office work.
V. Internet, e-mail and various online tools used in day-to-day office work.
VI. Trouble shooting of various lab equipment used in Physics Department.

- **Production and Industrial engineering**

III. Domain practical knowledge in relevant area, specific to laboratory and workshop equipment generally available in production and industrial engineering department.

IV. Basics of Machine Design, Kinematics and Dynamics of Machinery, Metallurgy and Heat Treatment, Industrial Engineering And Management, Computer Applications, Tool Design, Reliability, Maintenance and Safety Engineering

9. Assistant Registrar

General Awareness: Includes questions relating to History, Indian Polity & Constitution, Art & Culture, Geography, Economics, General Policy, Science & Scientific Research, National/International Organizations /Institutions, current events, environment etc.
Reasoning: Includes questions relating to both verbal and non-verbal types, analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc.
Mathematics: Includes questions relating to Simplification, Decimals, Fractions, L.C.M., H.C.F., Ratio & Proportion, Percentage, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Time & Work, Time & Distance, Tables & Graphs, etc.

Test of English or Hindi: In addition to the testing of candidate's understanding of the English or Hindi Languages, it's Vocabulary, Grammar, Sentence Structure,
Synonyms, Antonyms and its correct usage etc. would also be tested.
Computer Awareness: Includes questions on Operating System, MS Office, MS Word, MS Excel, Power Point, Tally, Internet, E-mail, Antivirus and various online tools used in day- to-day office work.

General Administration
Constitution of India, FR & SR, CCS Leave Rules, CCS Conduct Rules, CCS CCA Rules, CCS Pension Rules, New Pension Scheme, Disciplinary & Vigilance, LTC Rules, TA/DA Rules and other Allowances, GPF Rules, Office Procedure, Reservation & Concession in Services, Deputation, Foreign Service, Lien, Probation, Confirmation, Retirement, Resignation,

DPC, LDE, Seniority, General Financial Rules-2017 & 2022, GeM Rules, Delegation of Financial Power Rules, Budgeting & Internal Audit, HEFA/ PFMS, Medical Attendance Rules & CGHS, etc.

Government Acts, Laws relevant to Academic Administration
The Right to Information Act-2005, Anti Ragging Act, Labour Laws (including Maternity Benefits, Contractual Labour, Outsourcing, ESI/EPF, Gratuity etc.), the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act-2013, Information Technology Act-2000, Companies Act -2013, Indian Contract Act, Income Tax Act with focus on Salary Income, e-TDS, Financial Management of an Academic Institute, Service Tax Rules, GST Rules, etc.

IMPORTANT NOTE: THE SYLLABUS OF PART -B FOR THE POST OF TECHNICIAN/SR. TECHNICIAN AT MNIT JAIPUR IS AS FOLLOWS:

SYLLABUS FOR THE POST OF TECHNICIAN /SR. TECHNICIAN

Basic Science and Engineering

Units and Measurement
• Definition • Classifications: Fundamental and Derived units • Systems of units: FPS, CGS, MKS • Units of physical quantities, symbols • Conversion factors • Measurement of mechanical quantities, electrical quantities • Related problems
Mass Weight and Density
• Definition • Comparison between mass and weight • Comparison between density and relative density/specific gravity • Volume of different geometries (Cube, Cylinder, Cone, Sphere etc.) • Related problems **Work Power and Energy**
• Definition • Work and its Units, Measurement of work • Work done on bodies moving on horizontal and inclined planes (consider frictional forces also) Concept of Power and its units, Calculations of power (simple cases) • Concept of Kinetic energy and potential energy, Expressions for P.E and K.E • Principle of conservation of energy • Related problems
Speed and Velocity
• Definition of speed, velocity and their comparison • Scalar and Vector quantity • Average Velocity, Acceleration & Retardation • Equations of motion • Circular Motion: Relation between circular motion and Linear motion • Related problems
Heat and Temperature
• Definition • Specific Heat and Thermal Capacity • Types of heat: Sensible Heat, Latent Heat • Difference between heat and temperature • Different temperature scales and conversions • Temperature measuring instruments **Basic Electricity**
• Source of electricity: Battery, Generator, Thermocouple • Types of electric current: Direct current, Alternate current • Difference between AC and DC • Electrical Terms and units • Ohm's Law, Kirchhoff's law Relationships between Current, Volt, Resistance and Power • Resistance connections, Simple Problems on series and parallel circuits • Insulators: Properties and Classification • Conductors: Properties and Classification • Electric Power, Horse Power, Work and energy
Levers and Simple Machines
• Definitions • Velocity ratio, Mechanical Advantages, Efficiency and relationships • Ideal Machines • Lever: Principle, Types (First order lever, Second order lever, Third order lever) • Relationship, law of machine, simple machines

Occupational Safety, Health
• Safety & Health: Introduction and Importance of Occupational Safety and Health • Occupational Hazards: Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention • Accident & safety: Basic principles for protective equipment, Accident Prevention techniques – control of accidents and safety measures • First Aid:

Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person • Basic Provisions: Idea of basic provision of safety, health, welfare under legislation of India.

Environment Education

• Ecosystem: Introduction to Environment, Relationship between Society and Environment, Ecosystem and Factors causing imbalance • Pollution: Pollution and pollutants including liquid, gaseous, solid and hazardous waste • Energy Conservation: Conservation of Energy, re-use and recycle • Global warming: Global warming, climate change and Ozone layer depletion • Ground Water: Hydrological cycle, ground and surface water, Conservation and Harvesting of water • Environment: Right attitude towards environment, Maintenance of in-house environment.

I.T. Literacy

• Computer: Introduction, Computer and its applications, Hardware and peripherals, switching on and shutting down of computer • WINDOWS: Basics of Operating System, WINDOWS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc. • MS office: Basic operations of Word Processing (Cut /Copy /Paste/ Formatting), Basics of Excel worksheet (Commands/simple formulas and functions) • INTERNET: Computer Networks (LAN/WAN), Applications of Internet (Browsing, Searching, Emailing, Social Networking) • WEB Browser: World Wide Web (WWW), Web Browsing, Information Security and antivirus tools, Awareness of IT – ACT, Importance of information security and IT act, types of cyber crimes.

Physics: Nature of Universe-General Scientific laws-Inventions and discoveries National scientific laboratories-Mechanics and properties of matter-Physical quantities, standards and units-Force, motion and energy Magnetism, electricity and electronics -Heat, light and sound.

Chemistry: Elements and Compounds-Acids, bases and salts-Fertilizers, pesticides, insecticides, etc.

Basic Knowledge of Laboratories