

ADDENDUM**Sub:** Syllabus of Section-B (Technical Ability).**Ref:** Employment notification no.NO.CO/P-R/01/2024 dated 16/08/2024

Reference above, notification for filling up posts in various categories has been issued.

CBT pattern and syllabus of notified posts is given at clause 14 of notification. There are two sections in CBT, i.e. Section- A and Section-B (Technical Ability).

Syllabus of Section–A is mentioned in the notification. Syllabus of Section-B (Technical Ability) for the following posts are as enlisted in detail as under:

Post	Annexure	Clause no. of notification
Senior Section Engineer/Civil	Annexure-A	14.8
Senior Section Engineer/Electrical	Annexure-B	14.8
Technician-III/Electrical, Technician-III/Mechanical, ESTM	Annexure-C	14.10
Assistant Loco Pilot	Annexure-D	14.10

Candidates may please note that this is an indicative syllabus and not a fixed syllabus. The number of questions that may be asked on each topic are variable.

Candidate are also advised to visit the DGET website for obtaining detailed trade syllabus.

Chief Personnel Officer

Syllabus of Section – B (Technical Ability) for the post of Senior Section Engineer/Civil
(Clause no.14.7.1 and 14.8 of notification no.CO/P-R/01/2024)

- 1. Engineering Mechanics-** Force (resolution of force, moment of force, force system, composition of forces), Equilibrium, Friction, Centroid and Center of gravity, Simple machines.
- 2. Building Construction-** Building components (substructure, superstructure), type of structure (load bearing, framed and composite structures).
- 3. Building materials-** Masonry materials (stones, bricks, and mortars), Timber and miscellaneous materials (glass, plastic, fiber, aluminium steel, galvanized iron, bitumen, PVC, CPVC, and PPF).
- 4. Construction of substructure-** job layout, earthwork, foundation (types, dewatering, coffer dams, bearing capacity).
- 5. Construction of superstructure-** stone masonry, brick masonry, Hollow concrete block masonry, composite masonry, cavity wall, doors and windows, vertical communication (stairs, lifts, escalators), scaffolding and shoring.
- 6. Building finishes-** Floors (finishes, process of laying), walls (plastering, pointing, painting) and roofs (roofing materials including RCC).
- 7. Building maintenance-** Cracks (causes, type, repairs- grouting, guniting, epoxy etc.), settlement (causes and remedial measures), and re-baring techniques.
- 8. Building drawing-** Conventions (type of lines, symbols), planning of building (principles of planning for residential and public buildings, rules and byelaws), drawings (plan, elevation, section, site plan, location plan, foundation plan, working drawing), perspective drawing.
- 9. Concrete Technology-** Properties of various types/grades of cement, properties of coarse and fine aggregates, properties of concrete (water cement ratio, properties of fresh and hardened concrete), Concrete mix design, testing of concrete, quality control of concrete (batching, formwork, transportation, placing, compaction, curing, waterproofing), extreme weather concreting and chemical admixtures, properties of special concrete (ready mix, RCC, pre-stressed, fiber reinforced, precast, high performance).
- 10. Surveying-** Types of survey, chain and cross staff survey (principle, ranging, triangulation, chaining, errors, finding area), compass survey (principle, bearing of line, prismatic compass, traversing, local attraction, calculation of bearings, angles and local attraction) leveling (dumpy level, recording in level book, temporary adjustment, methods of reduction of levels, classification of leveling, tilting level, auto level, sources of errors, precautions and difficulties in leveling), contouring (contour interval, characteristics, method of locating, interpolation, establishing grade contours, uses of contour maps), area and volume measurements, plane table survey (principles, setting, method), theodolite survey (components, adjustments, measurements, traversing), Tacheometric survey, curves (types, setting out), advanced survey equipment, aerial survey and remote sensing.
- 11. Computer Aided Design-** CAD Software (AutoCAD, Auto Civil, 3D Max etc.), CAD commands, generation of plan, elevation, section, site plan, area statement, 3D view.
- 12. Geo Technical Engineering-** Application of Geo Technical Engineering in design of foundation, pavement, earth retaining structures, earthen dams etc., physical properties of soil, permeability of soil and seepage analysis, shear strength of soil, bearing capacity of soil, compaction and stabilization of soil, site investigation and sub soil exploration.
- 13. Hydraulics-** properties of fluid, hydrostatic pressure, measurement of liquid pressure in pipes, fundamentals of fluid flow, flow of liquid through pipes, flow through open channel, flow measuring devices, hydraulic machines.
- 14. Irrigation Engineering-** Hydrology, investigation and reservoir planning, percolation tanks, diversion head works.
- 15. Mechanics of Structures-** Stress and strain, shear force and bending moment, moment of inertia, stresses in beams, analysis of trusses, strain energy.
- 16 Theory of structures-** Direct and bending stresses, slope and deflection, fixed beam, continuous beam, moment distribution method, columns.
- 17. Design of Concrete Structures-** Working Stress method, Limit State method, analysis and design of singly reinforced and doubly reinforced sections, shear, bond and development length, analysis and design of T Beam, slab, axially loaded column and footings.

18. Design of Steel Structures- Types of sections, grades of steel, strength characteristics, IS Code, Connections, Design of tension and compression members, steel roof truss, beams, column bases.

19. Transportation Engineering- Railway Engineering (alignment and gauges, permanent way, railway track geometrics, branching of tracks, stations and yards, track maintenance), Bridge engineering (site selection, investigation, component parts of bridge, permanent and temporary bridges, inspection and maintenance), Tunnel engineering (classification, shape and sizes, tunnel investigation and surveying, method of tunneling in various strata, precautions, equipment, explosives, lining and ventilation).

20. Highway Engineering- Road Engineering, investigation for road project, geometric design of highways, construction of road pavements and materials, traffic engineering, hill roads, drainage of roads, maintenance and repair of roads.

21. Environmental Engineering- Environmental pollution and control, public water supply, domestic sewage, solid waste management, environmental sanitation, and plumbing.

22. Advanced Construction Techniques and Equipment- Fibers and plastics, artificial timber, advanced concreting methods (under water concreting, ready mix concrete, tremix concreting, special concretes), formwork, pre- fabricated construction, soil reinforcing techniques, hoisting and conveying equipment, earth moving machinery (exaction and compaction equipment), concrete mixers, stone crushers, pile driving equipment, working of hot mix bitumen plant, bitumen paver, floor polishing machines.

23. Estimating and Costing- Types of estimates (approximate, detailed), mode of measurements and rate analysis.

24. Contracts and Accounts- Types of engineering contracts, Tender and tender documents, payment, specifications.

**Syllabus of Section–B(Technical Ability) for the post of Senior Section Engineer/ Electrical
(Clause no.14.7.1 and 14.8 of notification no.CO/P-R/01/2024)**

- 1. Basic concepts:** Concepts of resistance, inductance, capacitance, and various factors affecting them. Concepts of current, voltage, power, energy and their units.
- 2. Circuit law:** Kirchhoff's law, Simple Circuit solution using network theorems.
- 3. Magnetic Circuit:** Concepts of flux, mmf, reluctance, Different kinds of magnetic materials, Magnetic calculations for conductors of different configuration e.g. straight, circular, solenoidal, etc. Electromagnetic induction, self and mutual induction.
- 4. AC Fundamentals:** 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-L and R-C circuit.
- 5. Measurement and measuring instruments:** Measurement of power (1 phase and 3 phase, both active and re- active) and energy, 2 wattmeter method of 3 phase power measurement. Measurement of frequency and phase angle. Ammeter and voltmeter (both moving coil and moving iron type), extension of range wattmeter, Multimeters, Megger, Energy meter AC Bridges. Use of CRO, Signal Generator, CT, PT and their uses. Earth Fault detection.
- 6. Electrical Machines:** (a) D.C. Machine – Construction, Basic Principles of D.C. motors and generators, their characteristics, speed control and starting of D.C. Motors. Method of braking motor, Losses and efficiency of D.C. Machines. (b) 1 phase and 3 phase transformers – Construction, Principles of operation, equivalent circuit, voltage regulation, O.C. and S.C. Tests, Losses and efficiency. Effect of voltage, frequency and wave form on losses. Parallel operation of 1 phase /3 phase transformers. Auto transformers. (c) 3 phase induction motors, rotating magnetic field, principle of operation, equivalent circuit, torque-speed characteristics, starting and speed control of 3 phase induction motors. Methods of braking, effect of voltage and frequency variation on torque speed characteristics, Fractional Kilowatt Motors and Single Phase Induction Motors: Characteristics and applications.
- 7. Synchronous Machines:** Generation of 3-phase e.m.f. armature reaction, voltage regulation, parallel operation of two alternators, synchronizing, control of active and reactive power. Starting and applications of synchronous motors.
- 8. Generation, Transmission and Distribution:** Different types of power stations, Load factor, diversity factor, demand factor, cost of generation, inter-connection of power stations. Power factor improvement, various types of tariffs, types of faults, short circuit current for symmetrical faults. Switchgears and Protection: Rating of circuit breakers, Principles of arc extinction by oil and air, H.R.C. Fuses, Protection against earth leakage / over current, etc. Buchholz relay, Merz-Price system of protection of generators & transformers, protection of feeders and bus bars. Lightning arresters, various transmission and distribution system, comparison of conductor materials, efficiency of different system. Cable – Different type of cables, cable rating and derating factor.
- 9. Estimation and costing:** Estimation of lighting scheme, electric installation of machines and relevant IE rules. Earthing practices and IE Rules.
- 10. Utilization of Electrical Energy:** Illumination, Electric heating, Electric welding, Electroplating, Electric drives and motors.
- 11. Basic Electronics:** Working of various electronic devices e.g. P N Junction diodes, Transistors (NPN and PNP type), BJT and JFET. Simple circuits using these devices.
- 12. Electronic Components & Materials:** Conductors, Semi conductor & Insulators; Magnetic materials; Jointing & Cleaning materials for U/G copper cable & OFC; Cells and Batteries (chargeable and non chargeable); Relays, Switches, MCB & Connectors.
- 13. Electronic Devices and circuits:** PN Junction diodes, thyristor; Diode and triode circuits; Junction Transistors; Amplifiers; Oscillator; Multivibrator, counters; Rectifiers; Inverter and UPS.
- 14. Digital Electronics:** Number System & Binary codes; Boolean Algebra & Logic gates; Combinational & Sequential logic circuits; A/D & D/A converter, counters; Memories
- 15. Linear Integrated Circuit:** Introduction to operational Amplifier; Linear applications; Non Linear applications; Voltage regulators; Timers; Phase lock loop.

16. Microprocessor and Microcontroller: Introduction to microprocessor, 8085 microprocessor working; Assembly Language programming; Peripherals & other microprocessors; Microcontrollers.

17. Electronic Measurements: Measuring systems; Basic principles of measurement; Range Extension methods; Cathode ray oscilloscope, LCD, LED panel; Transducers

18. Communication Engineering: Introduction to communication; Modulation techniques; Multiplexing Techniques; Wave Propagation, Transmission line characteristics, OFC; Fundamentals of Public Address systems, Electronic exchange, Radar, Cellular and Satellite Communication.

19. Data communication and Network: Introduction to data communication; Hardware and interface; Introduction to Networks and Networking devices; Local Area Network and Wide area network; Internet working.

20. Computer Programming: Programming concepts; Fundamentals of 'C' and C ++; Operators in 'C' and C ++; Control Statements; Functions, Array String & Pointers, File Structure; Data Structure and DBMS

21. Basic Electrical Engg.: DC Circuits; AC fundamentals; Magnetic, Thermal and Chemical effects of Electric current; Earthing - Installation, Maintenance, Testing,

22. Engineering Mechanics: Resolution of forces, Equilibrium and Equilibrant, parallelogram law of forces, triangle law of forces, polygon law of forces and Lami's theorem, couple and moment of a couple, condition for equilibrium of rigid body subjected to number of coplanar non-concurrent forces, definition of static friction, dynamic friction, derivation of limiting angle of friction and angle of repose, resolution of forces considering friction when a body moves on horizontal plane and inclined plane, calculation of moment of inertia and radius of gyration of : **(a)** I-Section **(b)** channel section **(c)** T-Section **(d)** L-Section (Equal & unequal lengths) **(e)** Z-Section **(f)** Built up sections (simple cases only), Newton's laws of motion (without derivation), motion of projectile, D'Alembert's principle, definition law of conservation of energy, law of conservation of momentum.

23. Material Science: Mechanical properties of engineering materials – tensile strength, compressive strength, ductility, malleability, hardness, toughness, brittleness, impact strength, fatigue, creep resistance. Classification of steels, mild steel and alloy steels. Importance of heat treatment. Heat treatment processes – annealing, normalizing, hardening, tempering, carburizing, nitriding and cyaniding.

24. Strength of Materials: Stress, strain, stress strain diagram, factor of safety, thermal stresses, strain energy, proof resilience and modulus of resilience. Shear force and bending moment diagram – cant lever beam, simply supported beam, continuous beam, fixed beam. Torsion in shafts and springs, thin cylinder shells.

25. Machining: Working principle of lathe. Types of lathes – Engine lathe – construction details and specifications. Nomenclature of single point cutting tool, geometry, tool signature, functions of tool angles. General and special operations – (Turning, facing, taper turning thread cutting, knurling, forming, drilling, boring, reaming, key way cutting), cutting fluids, coolants and lubricants. Introduction to shaper, slotter, plainer, broaching, milling and manufacture of gears, heat treatment process applied to gears.

26. Welding – Introduction, classification of welding processes, advantages and limitations of welding, principles of arc welding, arc welding equipment, choice of electrodes for different metals, principle of gas (oxy-acetylene) welding, equipment of gas welding, welding procedures (arc & gas), soldering and brazing techniques, types and applications of solders and fluxes, various flame cutting processes, advantages and limitations of flame cutting, defects in welding, testing and inspection modern welding methods, (submerged, CO₂, atomic – hydrogen, ultrasonic welding), brief description of MIG & TIG welding.

27. Grinding & Finishing Process: Principles of metal removal by grinding, abrasives, natural and artificial, bonds and binding processes, vitrified, silicate, shellac rubber, grinding machines, classification: cylindrical, surface, tool & cutter grinding machine, construction details, relative merits, principles of centreless grinding, advantages & limitations of centreless grinding work, holding devices, wheel maintenance, balancing of wheels, coolants used, finishing by grinding, honing, lapping, super finishing, electroplating, basic principles – plating metals, applications, hot dipping, galvanizing tin coating, parkerising, anodizing, metal spraying, wire process, powder process and applications, organic coatings, oil base paint, lacquer base enamels, bituminous paints, rubber base coating.

28. Metrology: Linear measurement – Slip gauges and dial indicators, angle measurements, bevel protractor, sine bar, angle slip gauges, comparators (a) mechanical (b) electrical (c) optical (d) pneumatic. Measurement of surface roughness; methods of measurements by comparison, tracer instruments and by interferometry, collimators, measuring microscope, interferometer, inspection of machine parts using the concepts of shadow projection and profile projection.

29. Fluid Mechanics & Hydraulic Machinery: Properties of fluid, density, specific weight, specific gravity, viscosity, surface tension, compressibility capillarity, Pascal's law, measurement of pressures, concept of buoyancy.

Concept of Reynold's number, pressure, potential and kinetic energy of liquids, total energy, laws of conservation, mass, energy and momentum, velocity of liquids and discharge, Bernoulli's equation and assumptions, venturi meters, pitot-tube, current meters. Working principle & constructional details of centrifugal pump, efficiencies – manometric efficiency, volumetric efficiency, mechanical efficiency and overall efficiency, cavitation and its effect, working principle of jet & submersible pumps with line diagrams.

30. Industrial Management: Job analysis, motivation, different theories, satisfaction, performance reward systems, production, planning and control, relation with other departments, routing, scheduling, dispatching, PERT and CPM, simple problems.

Materials in industry, inventory control model, ABC Analysis, Safety stock, re-order, level, economic ordering quantity, break even analysis, stores layout, stores equipment, stores records, purchasing procedures, purchase records, Bin card, Cardex, Material handling, Manual lifting, hoist, cranes, conveyors, trucks, fork trucks.

31. Thermal Engineering: Laws of thermo dynamics, conversion of heat into work vice versa, laws of perfect gases, thermo dynamic processes – isochoric, isobaric, isothermal hyperbolic, isentropic, polytropic and throttling, modes of heat transfer, thermal conductivity, convective heat transfer coefficient, Stefan Boltzman law by radiation and overall heat transfer coefficient.

Air standards cycles – Carnot cycle, Otto cycle, Diesel cycle, construction and working of internal combustion engines, comparison of diesel engine and petrol engine. Systems of internal combustion engine, performance of internal combustion engines.

Air compressors their cycles refrigeration cycles, principle of a refrigeration plant.

**Syllabus of Section–B (Technical Ability) for the post of Technician-III/Electrical,
Technician/Mechanical, ESTM.**

(Clause no.14.7.3 and 14.10 of notification no.CO/P-R/01/2024)

1) Semiconductor component number coding for different electronic components such as Diodes, Zeners. Types of wirings both domestic and industrial. Working principle of Transformer. Classification C.T, P.T Instrument and Auto Transformer (Variac), Uses of Conducting, Semi-Conducting and insulating materials, Series and Parallel connection of Electrical and Electronic components, Identify the primary and secondary transformer windings and test the polarity, Solders, flux and soldering technique, Brazing, Types & properties of resistors, Common Electrical wiring Accessories, Kirchoffs Laws and applications, Different methods of measuring the values of resistance, Comparison and Advantages D.C and A.C, Principle of different methods of earthing i.e, Pipe, Plate etc., Electrical Measuring Instruments-PMMC & MI meter (Ammeter, Voltmeter), Range extension, Multimeter (Digital/Analog), Wattmeter, P.Fmeter, Energy meter (Digital / analog), Insulation Tester(Megger), Earth tester, Frequency meter, Phase Sequence meter, Multimeter Analog and Digital, Tong tester, Tachometer, Explanation of alternator, types of prime mover, efficiency, regulations, phase sequence, Parallel operation, Armature winding terms, pole pitch, coil pitch, back pitch, front pitch, Lap and Wave winding, Progressive and retrogressive Winding, Code of practice and relevant span of Industrial Wiring,

2) Principal of Electricity, Concept of Potential difference. Current and resistance. Ohm's law, effect of temperature on resistance, resistance temperature coefficient, insulation resistance. SI units of work Power and Energy. Conversion of energy from one form to another in electrical and thermal systems, Types of Welding - Fundamentals of arc welding Oxy – Acetylene welding - principles, Types of Engine and there working principle, Differentiate between 2-stroke and 4 troke engine, Need for Cooling systems, Basic cooling system of engine, Type and Need for lubrication system, Physical and Mechanical properties of metals, Type of measurements and use of measuring instruments, Occupational safety and health, Environment Education, Levers and Simple Machines, Basic Electricity-Elements-Resistors, Capacitors, Chokes, Transformers, Current and Voltage, Ohms Law, Sires and Parallel circuits, Measuring Instrument, Basic Physics (Syllabus covered up to 10th standard)- Principle of Magnetism, Electricity, Velocities, Power supply system-Rectifiers, Regulators, Stabilisers, Inverters, Converters, DC/AC Motors, Secondary Cells, Batteries and their working principles and characteristics.

**Syllabus of Section–B (Technical Ability) for the post of Assistant Loco Pilot
(Clause no.14.7.4 and 14.10 of notification no.CO/P-R/01/2024)**

1) Engineering Drawing (Projections, Views, Drawing Instruments, Lines, Geometric figures, Symbolic Representation), Units, Measurements, Mass Weight and Density, Work Power and Energy, Speed and Velocity, Heat and Temperature, Basic Electricity, Lever. Basic concepts, Circuit law, Magnetic Circuit, AC Fundamentals, Measurement and measuring instruments, Electrical Machines, Synchronous Machines, Generation, Transmission and Distribution, Estimation and costing, Utilization of Electrical Energy, Basic Electronics. Electronic Components & Materials, Electronic Devices and circuits, Digital Electronics, Linear Integrated Circuit, Microprocessor and Microcontroller, Electronic Measurements, Communication Engineering, Data communication and Network, Computer Programming, Basic Electrical Engg., Strength of Materials, Fluid Mechanics and Machinery, Engineering Thermodynamics, Manufacturing Methods, Mathematics, Graphics Laboratory, Engineering Analysis and Numerical Methods, Heat Transfer and Combustion, Automotive Petrol Engines, Theory of Machines, Design of Machine Elements, Measurements and Instrumentation, Design of Mechanical Systems, Automotive Diesel Engines, Material Science & Technology, Power Units and Transmission, Automotive Chassis, Automotive Electrical Systems & Electronics, Vehicle Body Engineering, Two and Three Wheelers, Automotive Pollution and Control, Quality Control & Reliability Engineering, Vehicle Dynamics, Operations Research and Industrial Management, Elective-I, Ethics in Engineering Profession, Engineering Economy & Financial Management, Transport Management and Automobile Industry, Engineering Mechanics, Machining, Welding, Grinding & Finishing Process, Metrology, Industrial Management, Thermal Engineering.

2) Semiconductor component number coding, Working principle of Transformer, Series and Parallel connection of Electrical and Electronic components, Common Electrical wiring Accessories, Methods of measuring the values of resistance, Principle of earthing, Electrical Measuring Instruments, Armature winding terms, pole pitch, coil pitch, back pitch, front pitch, Lap and Wave winding, Progressive and retrogressive Winding, Industrial Wiring, Types of Welding, Fundamentals of arc welding, Principles of Oxy – Acetylene welding, Physical and Mechanical properties of metals, Occupational safety and health, Environment Education, Principle of Magnetism, Electricity, Velocities, Basic Physics, Power supply system-Rectifiers, Regulators, Stabilisers, Inverters, Converters, DC/AC Motors, Secondary Cells, Batteries and their working principles and characteristics, Solders, flux and soldering technique, Brazing, Need for Cooling, Heat Treatment, Manufacturing Techniques / Processe, Testing of components, Use of Test Instruments.
