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1st Stage CBT



Mathematics

Number systems, BODMAS, Decimals, Fractions, LCM and HCF, Ratio and Proportion, Percentages, Mensuration, Time and Work, Time and Distance, Simple and Compound Interest, Profit and Loss, Algebra, Geometry, Trigonometry, Elementary Statistics, Square Root, Age Calculations, Calendar & Clock, Pipes & Cistern.



General Intelligence and Reasoning

Analogies, Alphabetical and Number Series, Coding and Decoding, Mathematical operations, Relationships, Syllogism, Jumbling, Venn Diagram, Data Interpretation and Sufficiency, Conclusions and Decision Making, Similarities and Differences, Analytical reasoning, Classification, Directions, Statement – Arguments and Assumptions etc. c.



General Awareness

Knowledge of Current affairs, Indian geography, culture and history of India including freedom struggle, Indian Polity and constitution, Indian Economy, Environmental issues concerning India and the World, Sports, General Scientific and technological developments etc.



General Science

Physics, Chemistry and Life Sciences (up to 10th Standard CBSE syllabus).

2nd Stage CBT



General Awareness

Knowledge of Current affairs, Indian geography, culture and history of India including freedom struggle, Indian Polity and Constitution, Indian Economy, Environmental issues concerning India and the World, Sports, General Scientific and Technological Developments etc.



Physics and Chemistry

Up to 10th standard CBSE syllabus.



Basics of Computers and Applications

Architecture of Computers; input and Output devices; Storage devices, Networking, Operating System like Windows, Unix, Linux; MS Office; Various data representation; Internet and Email; Websites & Web Browsers; Computer Virus.



Basics of Environment and Pollution Control

Basics of Environment; Adverse effect of environmental pollution and control strategies: Air, water and Noise pollution, their effect and control; Waste Management, Global warming; Acid rain; Ozone depletion.

Technical Abilities

Syllabus for Civil & Allied Engineering Exam Group – JE



Engineering Mechanics

Force (resolution of force, moment of force, force system, composition of forces), Equilibrium, Friction, Centroid and Center of gravity, Simple machines.



Building Construction

Building components (substructure, superstructure), type of structure (load bearing, framed and composite structures).



Building materials

Masonry materials (stones, bricks, and mortars), Timber and miscellaneous materials (glass, plastic, fiber, aluminium steel, galvanized iron, bitumen, PVC, CPVC, and PPF).



Construction of substructure

Job layout, earthwork, foundation (types, dewatering, coffer dams, bearing capacity).



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.

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Technical Abilities (Continued)

	Building finishes	Floors (finishes, process of laying), walls (plastering, pointing, painting) and roofs (roofing materials including RCC).
	Building maintenance	Cracks (causes, type, repairs- grouting, guniting, epoxy etc.), settlement (causes and remedial measures), and re-bearing technique.
	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.
	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-atreased, fiber reinforced, precast, high performance).
	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) levelling (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 levelling), 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.
	Computer Aided Design	CAD Software (AutoCAD, Auto Civil, 3D Max etc.), CAD commands, generation of plan, elevation, section, site plan, area statement, 3D view.
	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.
	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.
	Irrigation Engineering	Hydrology, investigation and reservoir planning, percolation tanks, diversion head works.
	Mechanics of Structures	Stress and strain, shear force and bending moment, moment of inertia, stresses in beams, analysis of trusses, strain energy.
	Theory of structures	Direct and bending stresses, slope and deflection, fixed beam, continuous beam, moment distribution method, columns.
	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.
	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.

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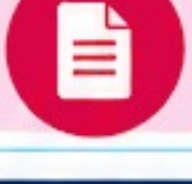
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Technical Abilities (Continued)

 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 tunnelling in various strata, precautions, equipment, explosives, lining and ventilation).
 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.
 Environmental Engineering	Environmental pollution and control, public water supply, domestic sewage, solid waste management, environmental sanitation, and plumbing.
 Advanced Construction Techniques and Equipment	Fibers and plastics, artificial timber, advanced concreting methods (under water concreting, ready mix concrete, tremix concreting, special concrete), 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.
 Estimating and Costing	Types of estimates (approximate, detailed), mode of measurements and rate analysis.
 Contracts and Accounts	Types of engineering contracts. Tender and tender documents, payment, specifications.

Syllabus for Electrical & Allied Engineering Exam Group – JE

 Basic concepts	Concepts of resistance, inductance, capacitance, and various factors affecting them. Concepts of current, voltage, power, energy and their units.
 Circuit law	Kirchhoff's law, Simple Circuit solution using network theorems.
 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.
 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 RLand R-C circuit.
 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 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. Earth Fault detection.
 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.

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Syllabus for Electrical & Allied Engineering Exam Group – JE (Continued)		
	3 Phase Induction Motors	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.
	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.
	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.
	Estimation and costings	Estimation of lighting scheme, electric installation of machines and relevant IE rules. Earthing practices and IE Rules.
	Utilization of Electrical Energy	Illumination, Electric heating, Electric welding, Electroplating. Electric drives and motors.
	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.

Syllabus for Electronics & Allied Engineering Exam Group – JE		
	Electronic Components & Materials	Conductors, Semi conductor & Insulators; Magnetic materials; Jointing & Cleaning materials for U/G cable & OFC; Cells and Batteries (chargeable and non chargeable); Relays, Switches, MCB & Connectors.
	Electronic Devices and circuits	PN Junction diodes, thyristor; Diode and triode circuits; Junction Transistors; Amplifiers; Oscillator; Multivibrator, counters; Rectifiers; Inverter and UPS.
	Digital Electronics	Number System & Binary codes; Boolean Algebra & Logic gates; Combinational & Sequential logic circuits; A/D & D/A converter, counters; Memories.
	Linear Integrated Circuit	Introduction to operational Amplifier; Linear applications; Non Linear applications; Voltage regulators; Timers; Phase lock loop.
	Microprocessor and Microcontroller	Introduction to microprocessor, 8085 microprocessor working; Assembly Language programming; Peripherals & other microprocessors; Microcontrollers.
	Electronic Measurements	Measuring systems; Basic principles of measurement; Range Extension methods; Cathode ray oscilloscope, LCD, LED panel; Transducers.
	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.

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Syllabus for Electrical & Allied Engineering Exam Group – JE (Continued)



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.



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



Basic Electrical Engg.

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

Syllabus for Mechanical & Allied Engineering Exam Group – JE



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.



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 steel. Importance of heat treatment. Heat treatment processes – annealing, normalizing, hardening, tempering, carburizing, nitriding and cyaniding.



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 – cantilever beam, simply supported beam, continuous beam, fixed beam. Torsion in shafts and springs, thin cylinder shells.



Machining

Working principle of lathe. Types of lathes – Engine lathe – construction details and specification. Nomenclature of single point cutting tool, geometry, tool signature, function 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, planer, broaching, milling and manufacture of gears, heat treatment process applied to gears.



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.



Grinding & Finishing Process

Principles of metal removal by grinding, abrasives, natural and artificial, bonds and binding processes, vitrified, silicate, shellac rubber, grinding machines.

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Grinding & Finishing Process

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, parkerizing, anodizing, metal spraying, wire process, powder process and applications, organic coatings, oil base paint, lacquer base enamels, bituminous paints, rubber base coating.



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.



Fluid Mechanics & Hydraulic Machinery

Properties of fluid, density, specific weight, specific gravity, viscosity, surface tension, compressibility capillarity, Pascall'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.



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.



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, polytrophic and throttling, modes of heat transfer, thermal conductivity, convective heat transfer coefficient.

Stefan Boltzmann 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.

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1st Stage CBT

Computer Based Test (CBT-I)

Subjects	No. of Questions	Marks for each Section
	CBT-I	CBT-I
Mathematics	30	30
General Intelligence & Reasoning	25	25
General Awareness	15	15
General Science	30	30
Total	100	100
Time in Minutes	90 minutes (120 Minutes for candidates who are eligible for use of a Scribe)	

There shall be negative marking in CBT (Computer Based Test/Examination) and marks shall be deducted for each wrong answer @ 1/3 of the marks allotted for each question.

2nd Stage CBT

Computer Based Test (CBT-II)

Subjects	No. of Questions	Marks for each Section
	CBT-II	CBT-II
General Awareness	15	15
Physics & Chemistry	15	15
Basics of Computers and Applications	10	10
Basics of Environment and Pollution Control	10	10
Technical Abilities	100	100
Total	150	150
Time in Minutes	120 minutes (160 Minutes for candidates who are eligible for use of a Scribe)	

There shall be negative marking in CBT (Computer Based Test/Examination) and marks shall be deducted for each wrong answer @ 1/3 of the marks allotted for each question.