

# Syllabus for the post of JUNIOR ENGINEER (Civil)

#### (A) WRITTEN TEST

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 material	Masonry materials (stones, bricks and mortars), Timber and miscellaneous
	materials (glass, plastic, fibre, aluminium steel, galvanized iron, bitumen,
	PVC, CPVC and PPF).
Construction of	Job layout, earthwork, foundation (types, dewatering coffer dams, bearing
substructure	capacity).
Construction of	Stone masonry brick masonry, Hollow concrete block masonry, composite
superstructure	masonry, cavity wall, doors and windows, vertical communication (stairs,
	lifts escalators), scaffolding and shoring.
Building finishes	Floors (finishes, process of laying), walls (plastering, pointing, painting) and
	roofing materials including RCC).
Building Maintenance	Cracks (causes, type, repairs- grouting, epoxy etc.), settlement (causes and
	remedial measures), and re-baring techniques.
Building drawing	Conventions (type of lines, symbols), planning of building (principles of
	planning for residential and public buildings, rules and byelaws), drawing
	(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, 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, fibre 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 levelling, tilting level, auto level, sources of errors,
	precautions and difficulties in levelling), contouring (contour interval,
	characteristics, methods of locating, interpolation, establishing grade
	contours, uses of contour maps), area and volume measurements, [lane table
	survey (principles, setting, method) theodolite survey (components,
	adjustments, measurements, traversing), Tachometric survey curves (types,
	setting out), advanced survey equipment, aerial survey and remote sensing.
Computer Aided Design	
computer mater Design	CAD Software (AutoCAD, Auto Civil, 3D Max etc.), CAD commands,

Geo Technical	Application of Geo Technical Engineering in design of foundation,
Engineering	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, measurements 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, diver
	head works.
Mechanics of Structure	Stress and strain, shear force and bending moment, moment of intertia
	stresses in beams analysis of trusses, strain energy.
Theory of structure	Direct and bending stresses, slope and deflection, fixed beam, continuous
	beam, moment distribution method, columns.
Design of Concrete	Working Stress method, Limit State method, analysis and design of singly
Structure	reinforced and doubly reinforced sections shear, bond and development
	length, analysis and design of T Beam, slab axially laded column and
	footings.
Design of Steel Structure	Types of sections, grades of steel, strength characteristics, IS Code,
	Connections, Design of tension and compression members, steel roof truss,
	beams, column bases.
Transportation	Railway Engineering (alignment and gauges, permanent way, railway track
Engineering	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,
Highway Engineering	explosives lining and ventilation).
Highway Engineering	Koad Engineering, investigation for road project geometric design of
	highways, construction of road pavements and materials trainc engineering,
Environmontal	Environmental pollution and control public water supply demostic sources
Environmental	solid waste management, environmental sonitation and plumbing
Advanced Construction	Fibers and plastice artificial timber advanced concreting methods (under
Techniques and	water concreting ready mix concrete tremix concreting special concretes)
Equipment	formwork pre-fabricated construction soil reinforcing techniques hosting
-1-1	and conveying equipment earth moving machinery (exaction and
	compaction equipment) concrete mixers stone crushers nile 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.
	specification.
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#### (B) SKILL TEST

- 1. Work procedure as per CPWD guidelines.
- 2. Knowledge of computer applications (like MS-Word, Excel, Power Point and E-Mail, etc.



# Syllabus for the post of JUNIOR ENGINEER (Electrical)

## (A) WRITTEN TEST

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 magnetics 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 signal, 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 signal response of R-Land 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, Megger, Energy meter AC Bridges. Use of CRO, Signal Generator, CT, PT and their uses. Earth Fault detection.
Electrical Machines	<ul> <li>(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.</li> <li>(b) 1 phase and 3 phase transformers- Constructions, 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 Induction Motors Characteristics and applications.</li> <li>(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.</li> <li>(d) 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 motors.</li> </ul>
Generation, Transmissions 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, Lighting arresters, various transmissions and distributions system, comparison of conductor materials, efficiency of different system Cable-Different type of cables, cable rating and derating factor.
Estimation and Costing	Estimation of lighting scheme, electrical installation of machines and relevant rules, Earthling practices and IE Rules.
Utilization of Electrical Engineering:	Illumination, Electric heating, Electric welding, Electroplating, Electric drivers and motors.
<b>Basic Electronics</b>	Working of various electronic devices e.g. P N Junction diodes Transistors (PNP and PNP type), BJT and JFET Simple circuits using these devices.
Air Conditioning	General principles of Refrigeration and Air-conditioning, Terminology, Factors affecting A.C. Load, Psychrometric chart, comfort air conditioning, General principles of window / split air conditioners.
Earthing	Design, Layout, and installation procedures for Building / Substation earth, Lightning protection and Surge protection devices.
Routine Work;	Preparation of estimate for electrical work, Estimation and costing of the electrical related work, Preparation of Notice inviting tender, Notice inviting Quotation and Market rate analysis.

### (B) SKILL TEST

- 1. Work procedure as per CPWD guidelines.
- 2. Knowledge of computer applications (like MS-Word, Excel, Power Point and E-Mail, etc.
- 3. Knowledge of measuring instrument (like Meggar, multimeter, watt hour meter, lux meter, db meter, temperature and pressure gauge etc.);
- 4. Switchgear and busbar system used at the 33/11 kV substation;
- 5. Earthing system used at SS and Buildings;
- 6. Lightning arrester used at Substation and high rise buildings;
- 7. DG operation and maintenance;
- 8. Overhead line of 33 kV;
- 9. Underground cabling of 33/11 kV (Laying procedure of cable, testing of cable etc.)
- 10. Knowledge about Transformer and sub-station yard maintenance.

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## Syllabus for the post of JUNIOR ENGINEER (Mechanical)

## (A) WRITTEN TEST

Mechanical Engineering	Energy and steam, forms Sources and Classification of energy, Steam
Science	boilers- classification, Classification, Principle of operation of Impulse
	and reaction, gas & water turbine, Classification, I.C. Engines parts,
	Refrigeration and Air conditioning, Lathe and Drilling Machines, Milling
	and Grinding Machines, Joining Processes, Lubrication and Bearings
	Soldering, Brazing and Welding, Power Transmission Belt Drives &
	Fasteners.
Engineering Mechanics	Introduction to engineering mechanics, Composition of forces, Free body
	diagram, equations of equilibrium, Conditions of static equilibrium for
	different force systems, Lami's theorem, Friction, Statically determinate
	beams, Centroids and moment of inertia.
Strength of Material	Stress and strain, Shear stress, Bending moment and Shear force
	diagrams, Elastic constants, principal stresses, Maximum stresses in
	beams, Deflection of beams, and Torsion of shaft
Engineering Drawing	Introduction, Drawing Instruments and their uses, BIS conventions,
	Lettering, Dimensioning and free hand practicing, Orthographic
	Projections, Orthographic Projections of plane surfaces, Projections of
	Solids, Sections and development of lateral Surfaces of Solids, Isometric
	projection (Using Isometric Scale only). Computer Assisted
	Drafting/Modeling.
Material Science &	Structure of crystalline solids, Diffusion, Diffusion Mechanism, Fick's
Metallurgy:	laws of diffusion. Gibbs phase rule, Binary phase diagrams, Iron-carbon
	Diagram. Mechanical Properties of Materials, Tension test, Hardness
	tests and impact tests, Elastic and Plastic behaviour, yield point
	phenomenon, True stress-true strain relationships, Types of fracture,
	stages in cup & cone fracture, Fatigue: fatigue tests, S-N Curves.
	<b>Composite Materials</b> : Types of composite materials. Properties of fibers
	and matrix materials. General methods of production, properties and
	applications of FRP,PRC, MMC and structural composites. Expressions
	for density, Young's modulus and strength of continuous fiber reinforced
	composites in iso- strain and iso - stress conditions. Applications of
	composite materials in aerospace, automobile and other fields.
THERMAL & FLUIDES	Thermodynamics: System, Surroundings, Boundary, Property, State,
ENGINEERING	Process, Cyclic process, Path function, point function, Zeroth law, first
	and second of thermodynamics. Carnot Cycle, Irreversibility and
	availability. Concept of Heat engines, efficiency of heat engine- concept
	of heat pump and Refrigerator coefficient of performance.
	Fluid Mechanics: Fluid-definition, concepts of continuum, shear stress as
	applied to fluids, fluid properties viscosity, Newton's law, surface
	tension, bulk modulus, compressibility, vapour pressure, capillarity,
	gauge and absolute pressures of a fluid. Principle of manometers, simple
	and differential manometers, Bourdon's pressure gauge, Pascal's law,

	Hydrostatic forces on plane and inclined surfaces. Archimedes principle,
	stability of foliation bodies. Bernoulli's equation, viscous flow of
	incompressible fluids, boundary layers.
Mechanical Measurements	Measurements and measurement systems: Definition, significance of
	measurement, generalized measurement system, definitions and concept
	of accuracy, precision, calibration, sensitivity, repeatability, linearity,
	standards of measurement, limits, fits, tolerance and gauging, principle
	of interchageability, Indian standards, comparators and angular
	measurement, mechanical and optical comparators, LVDT, Pneumatic
	comparators; Transducers, primary and secondary transducers,
	electrical, mechanical, electronic transducers; intermediate modifying
	and terminating devices: mechanical, cathode ray oscilloscope,
	oscillographs, X-Y plotters. Measurement of force, torque, pressure,
	temperature and strain.
Heating, Air conditioning a&	Air conditioning: Introduction to Air conditioning; Factors affecting Air
refrigeration System	conditioning; Psychometric chart and its use; Psychometric process-
	sensible heating and cooling, Humidifying and dehumidifying;
	Adiabatic saturation process; Equipments used in air conditioning cycle;
	Air conditioning units and plants. Retrigeration and Air-conditioning
	tools: lools used in retrigeration and Air conditioner installation;
	Installation procedure; Faults in retrigeration and air conditioning
Decembra	system; Servicing procedure
Pumps	Principle of working and applications, Types of casings and impellers,
	bood Work done Manametric officional Ouerall officional Numericals
	on calculations of overall officiency and power required to drive pumps
Steam Turbines	Impulse and Reaction Turbines: Condensers: let & Surface Condensers
Steam Turbines	Cooling Towers: Internal Combustion Engines and Refrigeration: Otto
	Diesel and Dual cycles: P-V and T-S Diagrams: IC Engines: 2 - Stroke and
	4 - Stroke I.C. Engines, S.I. and C.I. Engines.
Air Compressors	Functions of air compressor; Uses of compressed air; Types of air
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#### (B) SKILL TEST

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