भारतीय प्रौद्योगिकी संस्थान जोधपुर
Indian Institute of Technology Jodhpur

WRITTEN EXAM/ TRADE TEST SYLLABUS FOR THE POST OF JUNIOR ENGINEER (CIVIL/ELECTRICAL)

(A) SYLLABUS FOR THE POST OF JUNIOR ENGINEER (CIVIL)

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 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.
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	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, 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 Structure	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 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 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 concretes), formwork, pre-fabricated construction, soil reinforcing techniques, hosting 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, specification.

(B) SYLLABUS FOR THE POST OF JUNIOR ENGINEER (ELECTRICAL)

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	Instantantaneous, 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	**(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- 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. **(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. **(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 of synchronous motors.
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.
Basic Electronics	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.

TRADE TEST / COMPUTER TEST (CIVIL / ELECTRICAL)

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