

(c) **PHYSICAL EFFICIENCY TEST (PET)**

Those candidates found fit in Physical Standards Test (PST) will be put through Physical Efficiency Test (PET), which will be qualifying in nature. PET norms are as under :-

S/No	Male/ Female	One Mile Run	Standing Broad Jump	Clear the Ditch	Jump and reach
1.	Male	8 Minutes	4 Feet 6 Inch	6 Feet	7 Feet (Excluding 1 Feet reach)
2.	Female	12 Minutes	03 Feet	4 Feet	6 Feet (Excluding 1 Feet reach)

NOTE -I " A woman candidate, who as a result of tests is found to be pregnant of 12 weeks standing or over, shall be declared temporarily unfit and her appointment held in abeyance until the confinement is over. The vacancy against which a women candidate was selected should be kept reserved for her. She should be reexamined for Physical Efficiency Test (PET) six weeks after the date of confinement, subject to the production of the medical certificate of fitness from a registered medical practitioner. If she is found fit she may be appointed to the post kept reserved for and allow the benefit of seniority in accordance with the instructions of the government, as amended from time to time".

7. **SELECTION PROCEDURE**

POST OF SI (WORKS) & JE/SI (ELECTRICAL) :- The selection procedure for the posts of SI (Works) and JE/SI (Electrical) will be as under:-

(i) **FIRST PHASE :- WRITTEN EXAMINATION**

1st phase of examination i.e Written Exam will be conducted at the selection Examination Centres. There will be one composite paper for one hour Thirty Minutes duration. Question papers will be Objective Type with multiple choices on OMR based answer sheet, Question paper will be printed bilingual i.e in Hindi and English both and shall be consisting of the following subjects:-

	Subjects	Nos of Questions	Marks	Duration
Part-A	General intelligence & Reasoning	25 Questions	25 Marks	01 Hrs 30 Minutes
Part-B	General awareness	25 Questions	25 Marks	
Part-C	General Engineering (Civil/Electrical))	50 Questions	50 Marks	
Total		100 Questions carrying	100 Marks	

a) **SI (Works) and JE/SI (Electrical) :Standard and syllabus for Paper-I:-**

The written examination of paper-I shall be conducted from the following subject:-

(aa) General Intelligence & Reasoning : The syllabus for General Intelligence would include questions of both verbal and non-verbal type. The test may include questions on analogies, similarities, differences, space visualization, problem solving, analysis, judgments, decision making, visual memory, discrimination, observation, relationship concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc. The test will also include questions designed to test the candidates abilities to deal with abstract ideas and symbols and their relationships, arithmetical computations and other analytical functions.

(ab) General Awareness: Questions will be aimed at testing the candidates general awareness of the environment around him/her and its application to society. Questions will also be designed to test knowledge of current events and of such matters of everyday observation and experience in their scientific aspect as may be expected of any educated person. The test will also include questions relating to India and its neighboring countries especially pertaining to History, Culture, Geography, Economic Scene, General Polity and Scientific Research, etc. These questions will be such that they do not require a special study of any discipline.

(ac) General Engineering (Civil) Post of SI (Works) : Building Materials, Estimating, Costing and valuation, Surveying, Soil Mec engineering, Transportation Engineering, Environmental engineering.

(ad) General Engineering (Electrical) Post of JE/SI (Electrical) :Basic concepts, Circuit law, Magnetic Circuit, AC Fundamentals, Measurement and Measuring instruments, electrical machines, Fractional Kilowatt Motors and single phase induction motors, Synchronous Machines, Generation, Transmission and Distribution, estimator and Costing, Utilization and Electrical energy, Basic Electronics.

Note : During the written examination of paper-I (OMR based answer sheet), candidates have to fill and shade (in OMR answer sheet) their Name, Roll number, Date of Birth, question booklet series code i.e. A, B, C & D because these information are essential for evaluation of the answer sheet and publishing of result of qualified candidates. Circle as printed against each should be shaded correctly, otherwise candidate may be declared fail for which candidate himself will be responsible for such mistakes.

b) (Post of SI (Works) & JE/SI (Electrical) :-2nd Paper (Conventional Type) Time – 02 Hours

SI (Works)

aa) General Engineering (Civil) – 10 Questions – 100 Marks
(12 Questions will be given out of which 10 questions will be attempted)

JE/SI (Electrical)

ab) General Engineering (Electrical) – 10 Questions – 100 Marks
(12 Questions will be given out of which 10 questions will be attempted)

Standard and syllabus for Paper-II :

The written examination of paper-II shall be conducted from the following subject:-

a) SUB INSPECTOR (WORKS)

Building Materials : Physical and Chemical properties, classification, standard tests, uses and manufacture/quarrying of materials e.g. building stones, silicate based materials, cement (Portland), asbestos products, timber and wood based products, laminates, bituminous materials, paints, varnishes.

Estimating, Costing and Valuation : Estimate, glossary of technical terms, analysis of rates, methods and unit of measurement, Items of work- earthwork, Brick work (modular & Traditional bricks), RCC work, Shuttering, Timber work, Painting, Flooring, Plastering. Boundary wall, Brick building, Water tank, Septic tank, Bar bending schedule, Centre line method, Mid-section formula, Trapezoidal formula, Simpsons rule. Cost estimate of Septic tank, flexible pavements, Tube well, isolates and combined footings, steel Truss, Piles and pile-caps. Valuation – value and cost, scrap value, salvage value, assessed value, sinking fund, depreciation and obsolescence, methods of valuation.

Surveying : Principles of surveying, measurement of distance, chain surveying, working of prismatic compass, compass traversing, bearing, local attraction, plane table surveying, theodolite traversing, adjustment of theodolite, Levelling Definition of terms used in levelling, contouring, curvature and refraction

corrections, temporary and permanent adjustments of dumpy level, methods of contouring, uses of contour map, tachometric survey, curve setting, earth work calculation, advanced surveying equipment.

Soil Mechanics: Origin of soil, phase diagram, Definitions-void ratio, porosity, degree of saturation, water content, specific gravity of soil grains, unit weights, density index and interrelationship of different parameters, Grain size distribution curves and their uses, Index properties of soils, Atterberg's limits, ISI soil classification and plasticity chart. Permeability of soil, coefficient of permeability, determination of coefficient of permeability, Unconfined and confined aquifers, effective stress, quick sand, consolidation of soils, Principles of consolidation, Degree of consolidation, Pre-consolidation pressure, normally consolidated soil, e-Log p curve, computation of ultimate settlement. Shear strength of soils, Direct shear test, Vane shear test, Triaxial test. Soil compaction, Laboratory compaction test, Maximum dry density and optimum moisture content, earth pressure theories, active and passive earth pressures, Bearing capacity of soils, plate load test, standard penetration test.

Hydraulics : Fluid properties, Hydrostatics, measurements of flow, Bernoulli's theorem and its application flow through pipes, flow in open channels, weirs, flumes, spillways, pumps and turbines.

Irrigation Engineering : Definition, necessity, benefits, 211 effects of irrigation, types and methods of irrigation, Hydrology – Measurement of rainfall, run off coefficient, rain gauge, losses from precipitation – evaporation infiltration, etc. Water requirement of crops, duty delta and base period, Kharif and Rabi Crops, Command area, Time factor, crop ratio, overlap allowance, Irrigation efficiencies, Different type of canals, types of canal irrigation, loss of water in canals. Canal lining – types and advantages. Shallow and deep to wells, yield from a well. Weir and barrage, Failure of weirs and permeable foundation, Slit and scour, Kennedy's theory of critical velocity. Lacey's theory of uniform flow. Definition of flood, causes and effects, methods of flood control, water logging, preventive measure. Land reclamation, Characteristics of affecting fertility of soils, purposes, methods, description of land and reclamation processes. Major irrigation projects in India.

Transportation Engineering : Highway engineering – cross sectional elements, Geometric design, Types of pavements, pavements materials – aggregates and bitumen, different tests, Design of flexible and rigid pavements – Water Bound Macadam (WBM) and wet Mix Macadam (WMM), Gravel Road, Bituminous construction, Rigid pavement joint, pavement maintenance, Highway drainage, Railway Engineering – Components of permanent way – Sleepers, ballast, fixtures and fastening track geometry, points and crossings, track junction, stations and yards. Traffic Engineering – Different traffic survey, Speed-flow-density and their interrelationships, intersections and interchanges, traffic signals, traffic operation, traffic signs and marking, road safety.

Environmental Engineering : Quality of water, source of water supply, purification of water, distribution of water, need of sanitation, sewerage systems, circular sewer, oval sewer, sewer appurtenances, sewage treatments. Surface water drainage. Solid waste management – types, effects, engineered management system. Air pollution – Pollutants, causes, effects, control. Noise pollution – cause, health effects, control.

b) JUNIOR ENGINEER/SUB INSPECTOR (ELECTRICAL)

Standard and syllabus for Paper-II :

The written examination of paper-II shall be conducted from the following subject:-

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 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 coil and moving iron type), extension of range wattmeter, Multi meters, 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 characteristic, 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, 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 phases 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 – 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 costing : 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.

c) **QUALIFYING MARKS OF WRITTEN EXAM**

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| i) | For General/EWS/OBC category candidates | - 50% |
| ii) | For SC/ST category candidates | - 45% |

Note :-Number of candidates to be qualified in written examination will be restricted maximum ten times of number of vacancies or all qualified candidates whichever is less, for appearing in 2nd phase examination. There will be no re-evaluation of answer sheet.