

2. The following will be the subjects for the written examination:-

CIVIL ENGINEERING

Subject	Duration	Maximum Marks
Section I-Objective Papers		
General Ability Test (Part A: General English) (Part B: General Studies)	2 hrs.	200
Civil Engineering-Paper I	2 hrs.	200
Civil Engineering-Paper II	2 hrs.	200
Section II- Conventional Papers		
Civil Engineering – Paper I	3 hrs.	200
Civil Engineering – Paper II	3 hrs.	200
Total		1000

MECHANICAL ENGINEERING

Subject	Duration	Maximum Marks
Section I-Objective Papers		
General Ability Test (Part A: General English) (Part B: General Studies)	2 hrs.	200
Mechanical Engineering-Paper I	2 hrs.	200
Mechanical Engineering-Paper II	2 hrs.	200
Section II-Conventional Papers		
Mechanical Engineering-Paper I	3 hrs.	200
Mechanical Engineering- Paper II	3 hrs.	200
Total		1000

NOTE : Candidates are advised to read carefully special instructions to candidates for conventional type tests and objective type tests given in Appendix including the procedure regarding filling in the Answer Sheet of objective type tests in the Examination Hall.

3. In the Personality Test special attention will be paid to assess the candidate's capacity for leadership, initiative and intellectual curiosity, tact and other social qualities, mental and physical energy, powers of practical application and integrity of character.
4. Conventional papers must be answered in English. Question papers will be set in English only.
5. Candidates must write the papers in their own hand. In no circumstances will they be allowed the help of a scribe to write the answers for them. However, an extra time of twenty minutes per hour shall be permitted for the candidates with locomotor disability/cerebral palsy where dominant (writing) extremity is affected to the extent of slowing the performance of functions (minimum of 40% impairment) in the conventional type paper.
6. The minimum qualifying marks shall be fixed in any or all the papers of the examination in accordance with the resolution no. 13026 dated 27.11.2012 of the Department of Personnel, Administrative Reforms and Rajbhasha, Govt. of Jharkhand. The Objective Type papers as contained in Section-I of the Plan of the Examination will be evaluated first and evaluation of

the Conventional Type Papers contained in Section-II of the Plan of Examination will be done only of those candidates who obtain the minimum qualifying marks in Objective Types Papers, as fixed by the Commission.

7. Marks will not be allotted for mere superficial knowledge.
8. In the question papers, wherever required, SI units will be used.

NOTE : Candidates will be supplied with standard tables/charts in SI units in the Examination hall for reference purpose, wherever considered necessary.

9. Candidates are permitted to bring and use battery operated pocket calculators for conventional (essay) type papers only. Loaning or inter-changing of calculators in the Examination hall is not permitted. It is also important to note that candidates are not permitted to use calculators for answering Objective Type Paper (Test booklets). They should not, therefore, bring the same inside the Examination Hall.
10. Candidates should use only International form of Indian numerals (e.g.1,2,3,4,5,6, etc.) while answering question papers.

SCHEDULE TO APPENDIX

Standard and Syllabi

The standard of paper in General Ability Test will be such as may be expected of an Engineering/Science Graduate. The standard of papers in other subjects will approximately be that of an Engineering Degree Examination of an Indian University. There will be no practical examination in any of the subjects.

GENERAL ABILITY TEST

Part A: General English. The question paper in General English will be designed to test the candidate's understanding of English and workmanlike use of words.

Part B: General Studies: The paper in General Studies will include knowledge of current events and of such matters as of everyday observation and experience in their scientific aspects as may be expected of an educated person. The paper will also include questions on History of India and Geography of a nature which candidates should be able to answer without special study.

CIVIL ENGINEERING

PAPER-I

(For both objective and conventional type papers)

1. BUILDING MATERIALS

Timber : Different types and species of structural timber, density-moisture relationship, strength in different directions, defects, influence of defects on permissible stress, preservation, dry and wet rots, codal provisions for design, Plywood.

Bricks : Types, Indian Standard classification, absorptions, saturation factor, strength in masonry, influence of mortars strength on masonry strength.

Cement: Compounds of, different types, setting times, strength. Cement Mortar : Ingredients, proportions, water demand, mortars for plastering and masonry. Concrete: Importance of W/C Ratio, Strength, ingredients including admixtures, workability, testing for strength, elasticity, non-destructive testing, mix design methods.

2. **SOLID MECHANICS**

3. Elastic constants, stress, plane stress, Mohr's circle of stress, strains, plane strain, Mohr's circle of strain, combined stress; Elastic theories of failure; Simple bending, shear; Torsion of circular and rectangular sections and simple members.

4. **STRUCTURAL ANALYSIS**

Analysis of determinate structures – different methods including graphical methods. Analysis of indeterminate skeletal frames – moment distribution, slope-deflection, stiffness and force methods, energy methods, Muller-Breslau principle and application. Plastic analysis of indeterminate beams and simple frames – shape factors.

5. **DESIGN OF STEEL STRUCTURES**

Principles of working stress method. Design of connections, simple members, Built-up sections and frames. Design of Industrial roofs: Principles of ultimate load design. Design of simple members and frames.

6. **DESIGN OF CONCRETE AND MASONRY STRUCTURES**

Limit state design for bending, shear, axial compression and combined forces. Codal provisions for slabs, beams, walls and footings. Working stress method of design of R.C. members. Principles of prestressed concrete design, materials, methods of prestressing, losses. Design of simple members and determinate structures. Introductions to prestressing of indeterminate structures.

Design of brick masonry as per I.S. Codes.

7. **CONSTRUCTION PRACTICE, PLANNING AND MANAGEMENT**

Concreting Equipment: Weight Batcher, Mixer, vibrator, batching plant, concrete pump. Cranes, hoists, lifting equipment.

Earthwork Equipment.

Power shovel, hoe, dozer, dumper, trailers and tractor, rollers, sheep foot rollers, pumps.

Construction, Planning and Management:

Bar chart, linked bar chart, work-break down structures, Activity – on – arrow diagrams. Critical path, probabilistic activity durations; Event-based networks.

PERT network: Time-cost study, crashing; Resource allocation.

CIVIL ENGINEERING

PAPER-II

(For both objective and conventional type papers)

1. (a) **FLUID MECHANICS, OPEN CHANNEL FLOW, PIPE FLOW:**

Fluid Properties, Pressure, Thrust, Buoyancy; Flow Kinematics; Integration of flow equations; Flow measurement; Relative motion; Moment of momentum; Viscosity, Boundary layer and Control, Drag, Lift; dimensional Analysis, Modelling; Cavitation; Flow oscillations; Momentum and Energy principles in Open channel flow, Flow controls, Hydraulic jump, Flow sections and properties; Normal flow, Gradually varied flow; Surges; Flow development and losses in pipe flows, Measurements; Siphons; Surges and Water hammer; Delivery of Power Pipe networks.

(b) **HYDRAULIC MACHINES AND HYDROPOWER:**

Centrifugal pumps, types, performance parameters, scaling, pumps in parallel; Reciprocating pumps, air vessels, performance parameters; Hydraulic ram; Hydraulic turbines, types, performance

parameters, controls, choice; Power house, classification and layout, storage, pondage, control of supply.

2. (a) HYDROLOGY :

Hydrological cycle, precipitation and related data analyses, PMP, unit and synthetic hydrographs; Evaporation and transpiration; Floods and their management, PMF; Streams and their gauging; River morphology; Routing of floods; Capacity of Reservoirs.

(b) WATER RESOURCES ENGINEERING :

Water resources of the globe: Multipurpose uses of Water: Soil-Plant-Water relationships, irrigation systems, water demand assessment; Storages and their yields, ground water yield and well hydraulics; Waterlogging, drainage design; Irrigation revenue; Design of rigid boundary canals, Lacey's and Tractive force concepts in canal design, lining of canals; Sediment, transport in canals; Non-Overflow and overflow sections of gravity dams and their design, Energy dissipaters and tailwater rating; Design of headworks, distribution works, falls, cross-drainage works, outlets; River training.

3. ENVIRONMENTAL ENGINEERING

(a) WATER SUPPLY ENGINEERING :

Sources of supply, yields, design of intakes and conductors; Estimation of demand; Water quality standards; Control of Water-borne diseases; Primary and secondary treatment, detailing and maintenance of treatment units; Conveyance and distribution systems of treated water, leakages and control; Rural water supply; Institutional and industrial water supply.

(b) WASTE WATER ENGINEERING:

Urban rain water disposal; Systems of sewage collection and disposal; Design of sewers and sewerage systems; pumping; Characteristics of sewage and its treatment, Disposal of products of sewage treatment, streamflow rejuvenation Institutional and industrial sewage management; Plumbing Systems; Rural and semi-urban sanitation.

(c) SOLID WASTE MANAGEMENT

Source, classification, collection and disposal; Design and Management of landfills.

(d) AIR AND NOISE POLLUTION AND ECOLOGY:

4 (a) SOIL MECHANICS:

Properties of soil, classification and interrelationship: Compaction behavior, methods of compaction and their choice; Permeability and seepage, flow nets, Inverted filters; Compressibility and consolidation; Shearing resistance, stresses and failure; soil testing in laboratory and in-situ; Stress path and applications; Earth pressure theories, stress distribution in soil; soil exploration, samplers, load tests, penetration tests.

(b) FOUNDATION ENGINEERING:

Types of foundations, Selection criteria, bearing capacity, settlement, laboratory and field tests; Types of piles and their design and layout, Foundations on expansive soils, swelling and its prevention, foundation on swelling soils.

5. (a) SURVEYING:

Classification of surveys, scales, accuracy; Measurement of distances – direct and indirect methods; optical and electronic devices; Measurement of directions, prismatic compass, local attraction; Theodolites – types; Measurement of elevations – Spirit and trigonometric levelling; Relief representation; Contours; Digital elevation modelling concept; Establishment of control by triangulations and traversing – measurements and adjustment of observations, computation of coordinates; Field astronomy, Concept of global positioning system; Map preparation by plane tabling and by photogrammetry; Remote sensing concepts, map substitutes.

(b) TRANSPORTATION ENGINEERING :

Planning of highway systems, alignment and geometric design, horizontal and vertical curves, grade separation; Materials and construction methods for different surfaces and maintenance: Principles of pavement design; Drainage. Traffic surveys, Intersections, signalling; Mass transit systems; accessibility, networking. Tunnelling, alignment, methods of construction, disposal of muck, drainage, lighting and ventilation, traffic control, emergency management. Planning of railway systems, terminology and designs, relating to gauge, track, controls, transits, rolling stock, tractive power and track modernisation; Maintenance; Appurtenant works; Containerisation. Harbours – layouts, shipping lanes, anchoring, location identification; Littoral transport with erosion and deposition; sounding methods; Dry and Wet docks, components and operational Tidal data and analyses. Airports – layout and orientation; Runway and taxiway design and drainage management; Zoning laws; Visual aids and air traffic.

MECHANICAL ENGINEERING

(For both objective and conventional type papers)

PAPER-I

1. **Thermodynamics, Cycles and IC Engines** : Basic concepts, Open and Closed systems, Heat and work, Zeroth, First and Second Law, Application to non-flow and Flow processes, Entropy, Availability, Irreversibility and Tds relations. Claperyron and real gas equations, Properties of ideal gases and vapours, Standard vapour, Gas power and Refrigeration Cycles, Two stage compressor. C-I and S.I Engines. Pre-ignition, Detonation and Diesel-knock, Fuel injection and Carburation, Supercharging. Turbo-prop and Rocket engines, Engine Cooling, Emission & Control, Flue gas analysis, Measurement of Calorific values. Conventional and Nuclear fueis, Elements of Nuclear power production.
2. **Heat Transfer and Refrigeration and Air-conditioning** : Modes of heat transfer, One dimensional steady and unsteady conduction. Composite slab and Equivalent Resistance. Heat dissipation from extended surfaces, Heat exchangers, Overall heat transfer co-efficient, Empirical correlations for heat transfer in laminar and turbulent flows and for free and forced Convection, Thermal boundary layer over a flat plate, Fundamentals of diffusive and connective mass transfer, Black body and basic concepts in Radiation, Enclosure theory, Shape factor, Net work analysis. Heat pump and Refrigeration cycles and systems, Refrigerants. Condensers, Evaporates and Expansion devices, Psychrometry, Charts and application to air conditioning, Sensible heating and cooling, Effective temperature, Comfort indices, Load calculations, Solar refrigeration, controls, Duct design.
3. **Fluid Mechanics.**

Properties and classification of fluids, Manometry, forces on immersed surfaces, Center of pressure, Buoyancy, Elements of stability of floatation bodies. Kinematics and Dynamics. Irrotational and incompressible. Inviscid flow. Velocity potential, Pressure field and Forces on immersed bodies. Bernoulli's equation, Fully developed flow through pipes, Pressure drop calculations, Measurement of flow rate and Pressure drop. Elements of boundary layer theory, Integral approach, Laminar and turbulent flows, Separations. Flow over weirs and notches. Open channel flow, Hydraulic jump. Dimensionless numbers, Dimensional analysis, Similitude and modeling. One-dimensional isentropic flow, Normal shock wave, Flow through convergent-divergent ducts, Oblique shock-wave Rayleigh and Fanno lines.

4. Fluid Machinery and Steam Generators.

Performance, Operation and control of hydraulic Pump and impulse and reaction Turbines, Specific speed, Classification. Energy transfer, Coupling, Power transmission, Steam generators Fire-tube and water-tube boilers. Flow of steam through Nozzles and Diffusers, Wetness and condensation. Various types of steam and gas Turbines, Velocity diagrams. Partial admission. Reciprocating, Centrifugal and axial flow Compressors, Multistage compression, role of Mach Number, Reheat, Regeneration, Efficiency, Governance.

MECHANICAL ENGINEERING

PAPER – II

(For both objective and conventional type papers)

5. THEORY OF MACHINES:

Kinematic and dynamic analysis of planer mechanisms. Cams. Gears and gear trains. Flywheels. Governors. Balancing of rigid rotors and field balancing. Balancing of single and multi cylinder engines, Linear vibration analysis of mechanical systems. Critical speeds and whirling of shafts Automatic controls.

6. MACHINE DESIGN :

Design of Joints : cotters, keys, spines, welded joints, threaded fasteners, joints formed by interference fits. Design of friction drives : couplings and clutches, belt and chain drives, power screws. Design of Power transmission systems : gears and gear drives shaft and axle, wire ropes. Design of bearings : hydrodynamics bearings and rolling element bearings.

7. STRENGTH OF MATERIALS

Stress and strain in two dimensions, Principal stresses and strains, Mohr's construction, linear elastic materials, isotropy and anisotropy, stress-strain relations, uniaxial loadings, thermal stresses. Beams : Bending moment and shear force diagram, bending stresses and deflection of beams. Shear stress distribution. Torsion of shafts, helical springs. Combined stresses, thick and thin-walled pressure vessels. Struts and columns. Strain energy concepts and theories of failure.

8. ENGINEERING MATERIALS :

Basic concepts on structure of solids. Crystalline materials. Defects in crystalline materials Alloys and binary phase diagrams. Structure and properties of common engineering materials

Heat treatment of steels. Plastics, Ceramics and composite materials. Common applications of various materials.

9. PRODUCTION ENGINEERING

Metal Forming : Basic Principles of forging, drawing and extrusion; High energy rate forming; Powder metallurgy.

Metal Casting : Die casting, investment casting, Shell Moulding, Centrifugal Casting, Gating and Riser design; melting furnaces.

Fabrication Processes : Principles of Gas, Arc, Shielded arc Welding; Advanced Welding Processes, Weld ability: Metallurgy of Welding.

Metal Cutting : Turning, Methods of Screw Production, Drilling, Boring, Milling, ?ar Manufacturing, Production of fiat. surfaces, Grinding and Finishing Processes, Computer Controlled Manufacturing Systems-CNC, DNC, FMS, Automation and Robotics. Cutting Tools Materials, Tool Geometry, Mechanism of Tool Wear, Tool Life and Mach inability; Measurement of cutting forces. Economics of Machining Processes, Jigs and Fixtures. Fits and tolerances, Measurement of surface texture, Comparators Alignment tests and reconditioning of Machine Tools.

10. INDUSTRIAL ENGINEERING :

Production Planning and Control : Forecasting – Moving average, exponential smoothing, Operations, scheduling; assembly line balancing. Product development, Break-even analysis, Capacity planning, PERT and CPM.

Control Operations : Inventory control ABC analysis, EOQ model, Materials requirement planning. Job design, Job standards, Work measurement, Quality Management – Quality analysis and control.

Operations Research: Linear Programming- Graphical and Simplex methods. Transportation and assignment models. Single server queuing model.

Value Engineering : Value analysis for cost/value.

11. ELEMENTS OF COMPUTATION :

Computer Organisation, Flow charting, Features of Common computer Languages – FORTRAN, d Base III, Lotus 1-2-3, C and elementary Programming,

11. आरक्षण का लाभ :-

(i) आरक्षण का लाभ केवल झारखण्ड राज्य के स्थायी निवासी (कार्मिक, प्रशासनिक सुधार तथा राजभाषा विभाग, झारखण्ड सरकार के पत्रांक- 6763 दिनांक- 05.08.2016 के अनुसार) को झारखण्ड सरकार द्वारा जाति प्रमाण पत्र हेतु निर्धारित विहित प्रपत्र में उपायुक्त/अनुमण्डल पदाधिकारी स्तर से निर्गत जाति प्रमाण पत्र के आधार पर ही देय होगा।

(ii) अनुमान्य जाति प्रमाण पत्र हेतु विस्तृत निदेश निम्नवत् है:-

(a) अनुसूचित जनजाति/अनुसूचित जाति :-

झारखण्ड राज्य के अनुसूचित जनजाति एवं अनुसूचित जाति कोटि के अभ्यर्थियों को आरक्षण का लाभ कार्मिक, प्रशासनिक सुधार तथा राजभाषा विभाग, झारखण्ड सरकार के पत्रांक-5682 दिनांक