NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI – 620 015

Recruitment of Non-Teaching Positions-Group A

Syllabus for written test

POST: Executive Engineer (for Civil stream)

The list of eligible candidates as per the Essential Educational Qualification & Experience, mentioned in the Recruitment Rules 2019 for the post of EXECUTIVE ENGINEER in NITs will be displayed in the institute website. Those shortlisted applicants will have to undergo the following selection process, for final selection to the post of Executive Engineer (PB-3 (Rs. 15,600-39,100) with GP of Rs. 5400/-) by direct recruitment.

Stage	Type of Examination	Time duration	Maximum Marks
Stage - I	Multiple Choice Questions based Written Test with 30% weightage to Part A and 70% weightage to Part B	90 minutes	100
Stage - II	Personal Interview for the shortlisted candidates	–	-

- All questions of Stage - I will be Objective type and will carry one mark each. For every wrong answer, there will be negative marking @ 1/4th marks for each wrong answer. Compensatory time for Persons with Benchmark Disabilities (Divyangjan) will be provided as per the extant orders of Government of India.
- The candidates shortlisted for Stage - II will be displayed in the institute website after Stage - I examination.
- Part A questions are to test the General Aptitude and Reasoning Skills of the candidates whereas Part B questions are to test the domain knowledge. The syllabus for the above post is given below. Candidates may note that it is not exhaustive but indicative only.

PART A

1. Aptitude - Averages, Number System, Profit and Loss, Time and Work, Problems on Trains, Compound Interest, Decimal Fractions, Calendar, Area, Problems on Numbers, Square Root and Cube Root, Probability, Interest, Percentage, Ratio, Time and Distance, Problems on Ages, Partnership, Clock, Simplifications, Volume and Surface, Problems on H.C.F and L.C.M, Logarithm, Chain Rule, Pipes and Cistern, Odd Man Out and Series, Height and Distance

2. Reasoning - Number Series Compilation, Missing Number Finding, Continuous Pattern Series, Direction Sense Test, Puzzle, Verbal Classification, Matching Definitions, Logical Deduction, Series Compilations, Classification, Missing Character Finding, Odd Man Out, Blood Relations, Analogy, Coding and Decoding, Truth Verification of The Statement, Syllogisms, Analogies, Verbal Reasoning, Statement And Conclusions, Letter and Symbol Series, Logical Problems, Logical Sequence Of Words, Arithmetic Reasoning, Data Sufficiency.

3. General English- Antonyms, Synonyms, Spelling Check, Change of Voice, Spotting Errors, Sentence Improvement, One Word Substitute, Selecting Words, Sentence Corrections, Idioms And Phrases, Communication Skills, Common Error Detection, Sentence Compilation, Ordering of Words, Ordering of Sentences, Verbal Analogies, Sentence Formation, Completing Statements, Change of Speech.

4. Data Interpretation: Pie Chart, Bar Chart, Line Chart, Table Chart,

5. General Knowledge - Indian History, Indian Economy, Indian Culture, Environmental Science, Awards And Honors, Famous Places In India, World Organization, Sports, Books And Authors, Famous Personalities, Days And Years, Indian and World Geography, Indian Politics, General Sciences, and Current Affairs

6. Computer Fundamentals - Operating System, MS Office, Internet based operations and Database management

PART B

Structural Engineering

Strength of Materials: Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, buckling of column, combined and direct bending stresses; Instruments used to measure displacements, strains and loads.

Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Force methods: method of consistent deformation, column analogy method; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.

Construction Materials: Structural steel - composition, material properties and behaviour, standard tests on rebars; Cement, sand and aggregate – determination of engineering properties; Concrete –constituents, mix design, short-term and long-term properties, determination of engineering properties; Bricks and mortar; Timber – types of wood, seasoning of timber, mechanical properties, defects of timber, wood preservation techniques.

Reinforced Concrete (RC) Structures: Working stress, Limit state and Ultimate load design concepts; Design of beams, slabs, columns as per Indian Standards; Bond and development length; Prestressed concrete; Analysis of beam sections at transfer and service loads.

Steel Structures: Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases as per Indian Standards; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Design of purlins.

Geotechnical Engineering

Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Soil structure and fabric, clay mineralogy; Permeability – one dimensional flow, Darcy's law; Seepage through soils – two dimensional flow, flow nets, uplift pressure, piping; Principle of effective stress; Compaction in laboratory and field conditions; One-dimensional consolidation, time rate of consolidation; Effective and total shear strength parameters, characteristics of clays and sand. Sub-surface investigations; Earth pressure theories - Rankine and Coulomb; Stability of slopes – finite and infinite slopes,

method of slices and Bishop's method; Stress distribution in soils - Boussinesq's and Westergaard's theories, pressure bulbs; Shallow foundations - Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - types of piles, dynamic and static formulae, load capacity of piles in sands and clays, pile load test, negative skin friction; Pile groups, Relevant Indian standards.

Transportation Engineering

Highway planning: alignment, land-use – transportation interaction, urban transportation planning, parking. Traffic signs and road markings, Traffic intersections, Traffic rotary and signal design, IRC and BIS guidelines.

Geometric design: sight distance, horizontal and vertical alignments, superelevation, extra-widening.

Pavement technology: pavement systems and types, materials, mixtures, design, analysis, performance criteria, performance tests, MoRTH specifications, IRC guidelines, AASHTO methods. Pavement engineering laboratory: penetration tests, ring and ball apparatus, and rotational viscometer; aggregate toughness and specific gravities; Marshall mix design using Marshall hammer.

Water Resources Engineering

Fluid Mechanics: Fluid statics; Continuity, momentum, energy and corresponding equations; Flow in pipes, pipe networks.

Hydraulics: Flow measurement in channels and pipes; Basics of hydraulic machines; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, slope profile, hydraulic jump, uniform flow and gradually varied flow.

Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, infiltration, unit hydrographs, hydrograph analysis, reservoirs, watersheds, groundwater hydrology - aquifers.

Environmental Engineering

Water quality: Water quality parameters; Drinking water standards; Physical, chemical, and bacteriological analysis of water; Sample collection and data analysis; knowledge of physical and chemicals of analysis of environmental samples, Permissible limits as per BIS requirements.

Water and Wastewater treatment: Physicochemical treatment of water; Treatment of domestic Wastewater; Wastewater characteristics; Aerobic treatment of wastewater: Activated sludge process; Sequencing Batch Reactor (SBR); Trickling filters; Oxidation Ponds; basics of advanced water and wastewater treatment; basic knowledge of troubleshooting of water and wastewater treatment plants; knowledge of wastewater and solid waste disposal and disposal standards.

Solid waste management: Solid and hazardous waste management; Sampling and characterization of solid waste; Material and resource recovery/recycling from solid wastes; Basic knowledge on treatment and disposal techniques for solid waste – composting, Bio-methanisation, Integrated waste management practices.

Estimation and Construction management

Purpose and types of estimates, units of items of work, methods of building estimates, quantity takeoff, specifications and cost estimate, rate analysis; WBS and Bar charts; networks and relationships; Critical Path Methods (CPM); floats; resource levelling; PERT; Crashing, Tender and contractual requirements

Geomatics Engineering

Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing andtriangulation survey; Total station; Horizontal and vertical curves.

Photogrammetry and Remote Sensing - Scale, flying height; Basics of remote sensing and GIS.