Recruitment of Non-Teaching Positions

Scheme of Examination for direct recruitment to the post of Junior Engineer (Civil / Electrical)

[Advt No. Estt./2022/Gr_B2/2004 dated 17.10.2022]

Following shall be the selection process, scheme of examination, written test, syllabus, manner for final selection of candidates to the post of Junior Engineer (Civil / Electrical) (7th CPC Pay Level 6) by directrecruitment:

Stage	Type of Examination	Time	Maximum Marks
Stage - 1	**Multiple Choice Based Screening Test(MCQ-I)** (Paper-I) For screening the candidates for Paper-II (Stage-2)	90 Minutes	150 Marks (75 questions)
Stage - 2	**Multiple Choice Based Main Test (MCQ-II)** (domain specific of the post) (Paper-II), **Final selection based on Marks secured in Paper-II (Stage-2)**	120 Minutes	200 Marks (Part A - 20 questions Part B - 80 questions)
*Note:- Question papers will be in the **English** language **only**. All questions of Paper I and Paper II will be Objective type. 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.*			

A. Scheme of Examination

Paper-I: Multiple Choice Based Written Examination of 90-minutes duration (for screening the candidates for Paper-II Examination (Stage-2), Maximum marks 150). The examination for Paper-I (stage-1) shall be conducted first. Those candidates who will qualify in Paper-I shall only be eligible to appear for Paper-II (Stage-2). All the candidates are required to asses themselves before appearing in the written test about fulfilling eligibility for the post applied for. The eligibility and document verification of candidates will be assessed after evaluation of Paper–I examination. The shortlisting of candidates for stage-2 will be subject to limit of 10 times of the available advertised posts in the respective category. If the number of candidates qualifying in Paper-1 is more than 10 times, the shortlisting of candidates for Paper-2 (Stage-2) will be restricted to 10 times of the available advertised posts in the respective category. This number may increase in case of tie in the marks of paper-1 of the respective category and may decrease as per availability of candidates with qualifying marks in respective category. The Paper-II test (Stage-2) will be held after declaration of eligible shortlisted candidates after Paper-1 (Stage-1) examination. The indicative syllabus for paper-1 examination is as under:

(a) **General Knowledge & Awareness:** Includes questions relating to History, Indian Polity & Constitution, Art & Culture, Geography, Economics, General Policy, Science & Scientific Research, National/International Organizations /Institutions, current events, environment etc.

(b) **Quantitative Aptitude**- Includes questions relating to Simplification, Decimals, Fractions, L.C.M., H.C.F., Ratio & Proportion, Percentage, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Time & Work, Time & Distance, Tables & Graphs, etc.

(c) **Reasoning Ability:** Includes questions relating to both verbal and non-verbal types, analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc.

(d) **General English:** Includes questions on Antonyms, Synonyms, Spelling Check, Active/Passive Voice, Spotting Errors, Sentence Improvement, One Word Substitutes, Selecting Words, Sentence Corrections, Idioms and Phrases, Common Error Detection, Ordering of Words, Verbal Analogies, Sentence Formation, Completing Statements, Change of Speech.

(e) **Computer Fundamentals:** Includes questions on Operating System, MS Office, MS Word, MS Excel, Power Point, Tally, Internet, E-mail, Antivirus and various online tools used in day-to-day office work.

(f) **General Science:** The syllabus under this shall cover Physics, Chemistry and Life Sciences of 10th standard level.

B. Paper-II: Multiple Choice Based Main Test (MCQ-II) (200 Marks – 120 Minutes duration, Final selection based on Marks secured in Paper-II (Stage-2)). The minimum qualifying marks for Paper-II shall be 40% for UR & EWS, 36% for OBC, 32% for SC & ST, 28% for PwBD. Relaxed qualifying marks shall be applicable only for reserved category posts of respective category. The examination for paper-2 shall be held after declaration of result of Paper-I (Stage-1). Paper-II shall have two parts, i.e. Part A and Part B as detailed below:

INDICATIVE SYLLABUS (PAPER-II)

Part-A (20 questions)

Mathematics

- Number system, BODMAS, Decimals,
- Fractions, LCM, HCF, Ratio and Proportion,
- Percentages, Mensuration, Time and Work; Time and Distance,
- Simple and Compound Interest, Profit and Loss,
- Algebra, Geometry and Trigonometry, Elementary Statistics,
- Square Root, Age Calculations, Calendar & Clock etc.

General Intelligence and Reasoning

- Analogies, Alphabetical and Number Series,
- Coding and Decoding, Mathematical operations,
- Relationships, Syllogism, Jumbling,
- Venn Diagram, Data Interpretation and Sufficiency,
- Conclusions and decision making,
- Similarities and differences, Analytical reasoning,
- Classification, Directions, Statement – Arguments and Assumptions etc

Basic Science and Engineering

- Engineering Drawing (Projections, Views, Drawing Instruments, Lines, Geometric figures, Symbolic Representation),
- Units, Measurements, Mass Weight and Density, Work Power and Energy, Speed andVelocity, Heat and Temperature,
- Basic Electricity, Levers and Simple Machines, Occupational Safety and Health, Environment Education, IT Literacy etc

General Awareness on Current Affairs

- Science & Technology, Sports, Culture, Personalities, Economics, Politics and any other subjects of importance

PART-B (80 questions)

For Junior Engineer (Civil):

- **Estimating and Costing:** Analysis rates, Estimating of quantities of materials, Specifications (DSR, CSR etc.), Specifications for roads and bridges, Measurement of work methods, Project estimate and public works accounts, Contracts and measurement book, Knowledge of e-tendering for construction and maintenance activities, Arbitration and valuation, Quality assurance/quality control, Health and safety measures, Capacity building, PERT and CPM, Construction equipment and machinery, Knowledge of latest surveying and levelling equipment and techniques, Building bye laws.

- **Environmental Engineering:** Estimation of water demand, drinking water Standards, Planning and design of domestic waste water, sewage collection and disposal, Plumbing System. Components and layout of sewerage system, Industrial waste waters and Effluent Treatment Plants including institutional and industrial sewage management.
- **Design of Concrete and Steel structures:** Introduction of Reinforced concrete and steel design, Testing of concrete for fresh and hardened properties, Basics of concrete mix design, Maintenance of buildings and roads.
- **Engineering Mechanics:** Basic concepts of bending moment and shear force, Simple stress and strain, Simple bending theory, Flexural and shear stresses.
- **Soil Mechanics:** Origin of soils, Soil classification, Three-phase system, Fundamental definitions, Relationship and interrelationships, Permeability & seepage, Consolidation, Compaction, Shear strength.
- **Sub-surface Investigations-** penetration tests, plate load tests, Foundation types-foundation design requirements, Shallow foundations-bearing capacity, effect of water table and other factors, stress distribution, settlement analysis in sands and clays.
- **Fluid Properties, ideal and relations, laminar and turbulent Flows, Pipe flows, concept of open channel hydraulics.**

For Junior Engineer (Electrical):

- **Basic concepts:** Concepts of resistance, inductance, capacitance, and various factors affectingthem. 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 oil andmoving iron type), extension of range wattmeter, Multimeters, 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 – 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 of1 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, Fractional Kilowatt Motors and Single Phase Induction Motors: Characteristics and applications.
- **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, 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 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. Lightning arresters, various transmission and distribution

- **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. Manner for drawing final merit list for selection:

(i) The written examination for Paper-I (stage-1) shall be conducted first. Those candidates who will qualify in Paper-I shall only be eligible to appear for Paper-II Examination (Stage-2). The venue & date of examination will be communicated in due course of time.

(ii) The final merit list shall be drawn on the basis of scores of Paper II only.

(iii) In case of tie/bunching/bracketing of candidates in the final results, the following criteria shall be adopted in the following sequential order for deciding Merit list:

(a) The candidate with higher marks in Paper-II shall be placed higher on the merit list or
(b) If (a) above is same, the candidate with less number of negative answers in Paper-II, shall be placedhigher on the merit list, or
(c) If (a) & (b) above is same, the candidate with higher marks in Part B of Paper-II shall be placed higher on the merit list, or
(d) If (a), (b) & (c) above is same, the candidate senior in age shall be placed higher on the merit list, or
(e) In case option at (a), (b), (c) & (d) are exhausted, it will be decided through draw.

Note:

- **Any guidelines/instructions received from Ministry of Education, Government of India till the date of completion of Selection process will be made applicable.**
- **The Date, Time, Venue of examination will be communicated in due course of time. The candidates are requested to regularly check the institute website for all updates.**

This is issued with the approval of the Competent Authority.

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