Engineering Services Examination (ESE) 2025

A Complete Guide for Civil Engineering

Compiled with Information from UPSC and Educational Resources

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Contents

1 Introduction to ESE

The Engineering Services Examination (ESE), formerly known as the Indian Engineering Services (IES) examination, is a national-level competitive exam conducted by the Union Public Service Commission (UPSC) to recruit engineers into various central government departments and organizations. The examination selects candidates for Class-1 officer positions in technical and managerial roles across diverse sectors, including Indian Railways, Power, Telecommunications, Central Water Engineering, Defense Services, and Central Engineering Services.

2 Exam Structure

The ESE follows a three-stage examination process designed to evaluate candidates' technical knowledge, aptitude, and personality:

2.1 Preliminary Examination (Objective Type)

- **Paper 1:** General Studies and Engineering Aptitude (200 marks, 2 hours) - Common to all disciplines
- **Paper 2:** Civil Engineering (300 marks, 3 hours) - Discipline-specific
- Total: 500 marks
- Negative Marking: 1/3 mark deducted for each incorrect answer

2.2 Main Examination (Conventional Type)

- **Paper 1:** Civil Engineering (300 marks, 3 hours)
- **Paper 2:** Civil Engineering (300 marks, 3 hours)
- Total: 600 marks

2.3 Personality Test/Interview

- Marks: 200
- Assesses personality, communication skills, leadership qualities, and suitability for engineering services

The maximum total score is 1,300 marks across all three stages.

3 Syllabus

The syllabus for the ESE 2025 for Civil Engineering is divided into two papers for both the Preliminary and Main Examinations.

3.1 General Studies and Engineering Aptitude (Preliminary Examination, Paper I)

1. Current issues of national and international importance relating to social, economic, and industrial development

2. Engineering Aptitude covering Logical reasoning and Analytical ability
3. Engineering Mathematics and Numerical Analysis
4. General Principles of Design, Drawing, Importance of Safety
5. Standards and Quality practices in production, construction, maintenance, and services
6. Basics of Energy and Environment: Conservation, environmental pollution and degradation, Climate Change, Environmental impact assessment
7. Basics of Project Management
8. Basics of Material Science and Engineering
9. Information and Communication Technologies (ICT) based tools and their applications in Engineering such as networking, e-governance, and technology-based education
10. Ethics and values in Engineering profession

Note: The paper in General Studies and Engineering Aptitude will include knowledge of relevant topics as may be expected from an engineering graduate without special study. Questions from all 10 topics shall be set, with marks for each topic ranging from 5% to 15% of the total marks.

3.2 Civil Engineering

3.2.1 Paper I

1. **Building Materials:** Stone, Lime, Glass, Plastics, Steel, FRP, Ceramics, Aluminum, Fly Ash, Basic Admixtures, Timber, Bricks, and Aggregates: Classification, properties, and selection criteria; Cement: Types, Composition, Properties, Uses, Specifications, and various Tests; Lime & Cement Mortars and Concrete: Properties and various Tests; Design of Concrete Mixes: Proportioning of aggregates and methods of mix design.
2. **Solid Mechanics:** Elastic constants, Stress, plane stress, Strains, plane strain, Mohrs circle of stress and strain, Elastic theories of failure, Principal Stresses, Bending, Shear, and Torsion.
3. **Structural Analysis:** Basics of strength of materials, Types of stresses and strains, Bending moments and shear force, concept of bending and shear stresses; Analysis of determinate and indeterminate structures; Trusses, beams, plane frames; Rolling loads, Influence Lines, Unit load method & other methods; Free and Forced vibrations of single degree and multi-degree freedom system; Suspended Cables; Concepts and use of Computer Aided Design.
4. **Design of Steel Structures:** Principles of Working Stress methods, Design of tension and compression members, Design of beams and beam column connections, built-up sections, Girders, Industrial roofs, Principles of Ultimate load design.
5. **Design of Concrete and Masonry Structures:** Limit state design for bending, shear, axial compression, and combined forces; Design of beams, Slabs, Lintels,

Foundations, Retaining walls, Tanks, Staircases; Principles of pre-stressed concrete design including materials and methods; Earthquake resistant design of structures; Design of Masonry Structure.

6. **Construction Practice, Planning, and Management:** Construction - Planning, Equipment, Site investigation, and Management including Estimation with latest project management tools and network analysis for different Types of works; Analysis of Rates of various types of works; Tendering Process and Contract Management, Quality Control, Productivity, Operation Cost; Land acquisition; Labour safety and welfare.

3.2.2 Paper II

1. **Flow of Fluids, Hydraulic Machines, and Hydro Power:**
   (a) Fluid Mechanics, Open Channel Flow, Pipe Flow: Fluid properties; Dimensional Analysis and Modeling; Fluid dynamics including flow kinematics and measurements; Flow net; Viscosity, Boundary layer and control, Drag, Lift, Principles in open channel flow, Flow controls. Hydraulic jump; Surges; Pipe networks.
   (b) Hydraulic Machines and Hydro power: Various pumps, Air vessels, Hydraulic turbines types, classifications & performance parameters; Power house classification and layout, storage, pondage, control of supply.
2. **Hydrology and Water Resources Engineering:** Hydrological cycle, Ground water hydrology, Well hydrology, and related data analysis; Streams and their gauging; River morphology; Flood, drought, and their management; Capacity of Reservoirs. Water Resources Engineering: Multipurpose uses of Water, River basins, and their potential; Irrigation systems, water demand assessment; Resources - storages and their yields; Water logging, canal, and drainage design, Gravity dams, falls, weirs, Energy dissipaters, barrage Distribution works, Cross drainage works, and head-works and their design; Concepts in canal design, construction & maintenance; River training, measurement, and analysis of rainfall.
3. **Environmental Engineering:**
   (a) Water Supply Engineering: Sources, Estimation, quality standards, and testing of water and their treatment; Rural, Institutional, and industrial water supply; Physical, chemical, and biological characteristics and sources of water, Pollutants in water and its effects, Estimation of water demand; Drinking water Standards, Water Treatment Plants, Water distribution networks.
   (b) Waste Water Engineering: Planning & design of domestic waste water, sewage collection, and disposal; Plumbing Systems. Components and layout of sewerage system; Planning & design of Domestic Waste-water disposal system; Sludge management including treatment, disposal, and re-use of treated effluents; Industrial waste waters and Effluent Treatment Plants including institutional and industrial sewage management.
   (c) Solid Waste Management: Sources & classification of solid wastes along with planning & design of its management system; Disposal system, Beneficial as-

pects of wastes and Utilization by Civil Engineers.

(d) Air, Noise pollution, and Ecology: Concepts & general methodology.

4. **Geo-technical Engineering and Foundation Engineering:**

   (a) Geo-technical Engineering: Soil exploration - planning & methods, Properties of soil, classification, various tests, and interrelationships; Permeability & Seepage, Compressibility, consolidation, and Shearing resistance, Earth pressure theories, and stress distribution in soil; Properties and uses of geosynthetics.

   (b) Foundation Engineering: Types of foundations & selection criteria, bearing capacity, settlement analysis, design, and testing of shallow & deep foundations; Slope stability analysis, Earthen embankments, Dams, and Earth retaining structures: types, analysis, and design, Principles of ground modifications.

5. **Surveying and Geology:**

   (a) Surveying: Classification of surveys, various methodologies, instruments & analysis of measurement of distances, elevation, and directions; Field astronomy, Global Positioning System; Map preparation; Photogrammetry; Remote sensing concepts; Survey Layout for culverts, canals, bridges, road/railway alignment, and buildings, Setting out of Curves.

   (b) Geology: Basic knowledge of Engineering geology & its application in projects.

6. **Transportation Engineering:**

   - Highways - Planning & construction methodology, Alignment, and geometric design; Traffic Surveys and Controls; Principles of Flexible and Rigid pavements design.
   - Tunneling - Alignment, methods of construction, disposal of muck, drainage, lighting, and ventilation.
   - Railways Systems Terminology, Planning, designs, and maintenance practices; track modernization.
   - Harbours Terminology, layouts, and planning.
   - Airports Layout, planning & design.

4 Eligibility Criteria

4.1 Educational Qualification

Candidates must possess:

- A degree in Civil Engineering from a recognized university
- OR passed Sections A and B of Institution of Engineers (India)
- OR equivalent qualifications from recognized foreign institutions

4.2 Age Limit

- General Category: 21-30 years (as of January 1, 2025)
- Age Relaxations:
  - SC/ST: Up to 5 years
  - OBC: Up to 3 years
  - PwBD: Up to 10 years
  - Ex-servicemen: Up to 5 years
  - Government employees: Up to 5 years (specific conditions apply)

5 Services Available for Civil Engineering

The ESE offers positions in prestigious organizations:

- Central Engineering Service (Civil)
- Central Engineering Service (Roads), Group-A
- Survey of India Group 'A' Service
- Border Roads Engineering Service (AEE Civil)
- Indian Defence Service of Engineers
- Military Engineer Service (AEE QS&C)
- Central Water Engineering (Group 'A') Service
- Indian Skill Development Service

6 Reference Books

The following table lists recommended books for key civil engineering subjects:

Subject	Recommended Books	Authors
Strength of Materials	Strength of Materials	Stephen Timoshenko, B.G
Structural Analysis	Theory of Structures	Ramamruthan, C.K. Wan
Concrete Structures	Design of Concrete Structures	Punmia, Jain, H.J. Shah
Steel Structures	Design of Steel Structures	S.K. Duggal
Soil Mechanics	Soil Mechanics and Foundation Engineering	Ranjan Rao, S.K. Garg
Fluid Mechanics	Fluid Mechanics and Hydraulic Machinery	Modi Seth, R.K. Bansal
Transportation	Highway Engineering	Khanna, Justo, Kadiyali
Environmental Engineering	Environmental Engineering	S.K. Garg
Surveying	Surveying	B.C. Punmia

Table 1: Recommended Books for ESE Civil Engineering Preparation

7 Preparation Strategy

To excel in the ESE, candidates should adopt a structured preparation approach:

- **Understand the Syllabus:** Prioritize topics based on weightage and personal strengths.
- **Study Core Subjects:** Focus on civil engineering fundamentals using recommended textbooks.
- **Practice Past Papers:** Solve previous years questions to understand patterns and improve time management.
- **Join Test Series:** Enroll in mock tests to simulate exam conditions and evaluate performance.
- **Regular Revision:** Create concise notes for quick review, especially for formulas and key concepts.
- **Stay Updated:** Follow current affairs related to engineering and infrastructure for the General Studies paper.

8 Career Opportunities and Salary

Successful candidates can secure roles such as Assistant Executive Engineer in organizations like:

- Indian Railways
- Central Engineering Services
- Military Engineering Services

Career progression can lead to senior positions like Chief Engineer or Chairman/Managing Director. The starting salary is approximately Rs. 85,000 per month, including allowances, based on the 7th Pay Commission (Level 10, basic pay Rs. 56,100).

9 Conclusion

The ESE 2025 offers a prestigious opportunity for civil engineering graduates to contribute to Indias infrastructure development. By following a disciplined preparation strategy and leveraging recommended resources, candidates can enhance their chances of securing a rewarding career in government service.