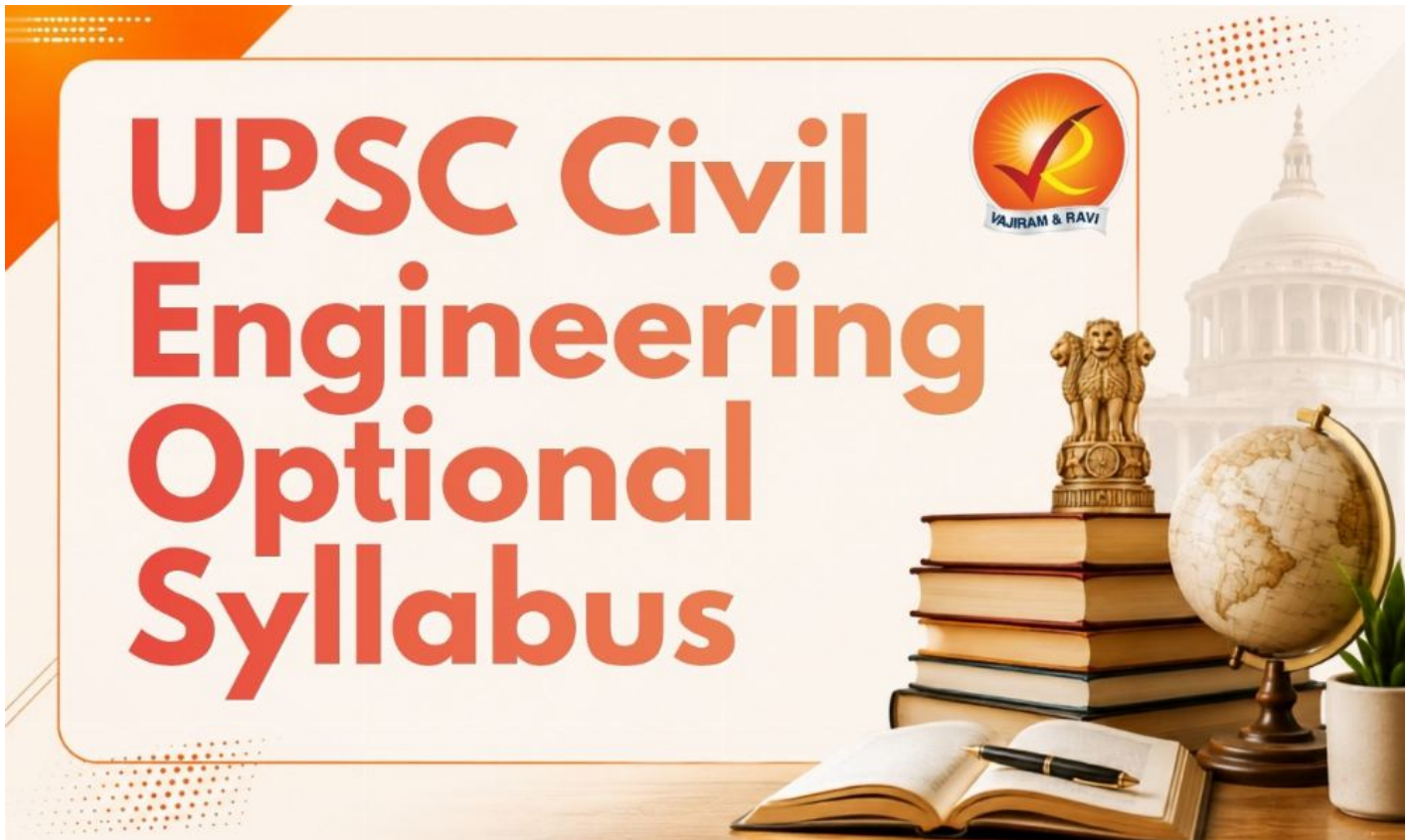


UPSC Civil Engineering Optional Syllabus 2026 for CSE Mains Paper 1 & 2

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The Union Public Service Commission (UPSC) offers Civil Engineering as one of the 48 optional subjects for the UPSC Mains Exam, specifically for candidates with a Bachelor's or Master's degree in Civil Engineering. Choosing Civil Engineering as an optional subject can be a strategic decision, especially if the candidate aims to score well in the optional exam. This article covers the syllabus, recommended books, preparation strategy of selecting Civil Engineering as an optional subject.

UPSC Civil Engineering Syllabus

The UPSC Mains Exam offers Civil Engineering, Mechanical Engineering, and Electrical Engineering as optional subjects. Civil Engineering primarily deals with the design and maintenance of physical and environmental structures like bridges and buildings.

It is generally recommended for candidates with an engineering background since it is a technical subject. Without prior knowledge, candidates may find it difficult to understand the concepts. For Civil Engineering graduates, choosing this optional can be time-saving as a significant portion of the syllabus is already covered with their

UPSC Civil Engineering Syllabus for Paper 1

The UPSC Civil Engineering Syllabus for Paper 1 includes the topics covered during their engineering course including subjects like Engineering Mechanics, Strength of Materials, Structural Analysis, and Design of Structures. For a detailed subject description, refer to the table below.

UPSC Civil Engineering Syllabus for Paper 1	
Topic	Subtopic
Engineering Mechanics, Strength of Materials, and Structural Analysis	
1.1 Engineering Mechanics	• Units and Dimensions , SI Units, Vectors, Concept of Force, Concept of particle and rigid body. • Concurrent, Non- Concurrent, and parallel forces in a plane , moment of force free body diagram, conditions of equilibrium, Principle of virtual work, equivalent force system. • First and Second Moment of area, Mass moment of Inertia. • Static Friction. • Kinematics and Kinetics : Kinematics in cartesian Coordinates, motion under uniform and non-uniform acceleration, motion under gravity. • Kinetics of particles: Momentum and Energy principles, collision of elastic bodies, rotation of rigid bodies.
1.2 Strength of Materials	• Simple Stress and Strain, Elastic constants, axially loaded compression members, Shear force and bending moment, theory of simple bending, Shear Stress distribution across cross sections, and Beams of uniform strength. • Deflection of beams: Mecauly's method, Mohr's Moment area method, Conjugate beam method, and unit load method. Torsion of Shafts, Elastic stability of columns, Euler's, Rankine's, and Secant formula.

1.3 Structural Analysis	• Castigliano's theorems I and II, unit load method, of consistent deformation applied to beams and pin jointed trusses. Slope-deflection, moment distribution. • Rolling loads and Influences lines : Influences lines for Shear Force and Bending moment at a section of a beam. Criteria for maximum shear force and bending Moment in beams traversed by a system of moving loads. Influences lines for simply supported plane pin jointed trusses. • Arches : Three-hinged, two-hinged, and fixed arches, rib shortening and temperature effects. • Matrix methods of analysis: Force method and displacement method of analysis of indeterminate beams and rigid frames. • Plastic Analysis of beams and frames : Theory of plastic bending, plastic analysis, statical method, Mechanism method. • Unsymmetrical bending : Moment of inertia, product of inertia, position of Neutral Axis and Principal axes, calculation of bending stresses.
Design of Structures: Steel, concrete, and masonry structures	
2.1 Structural Steel Design	• Structural steel: Factors of safety and load factors. Riveted, bolted, and welded joints and connections. Design of tension and compression members, beams of built-up section, riveted and welded plate girders, gantry girders, stanchions with battens, and bracings.
2.2 Design of Concrete and Masonry Structures	• Concept of mixed design. Reinforced Concrete: Working Stress and Limit State method of design—Recommendations of I. S. codes. design of one-way and two-way slabs, stair-case slabs, simple and continuous beams of rectangular, T, and L sections. compression members under direct load with or without eccentricity. • Cantilever and Counterfort type retaining walls. • Water tanks: Design requirements for Rectangular and circular tanks resting on the ground. • Prestressed Concrete: Methods and systems of prestressing, anchorages, Analysis, and design of sections for flexure based on working stress, and loss of prestress. • Design of brick masonry as per I. S. Codes
Fluid Mechanics, open channel flow, and Hydraulic Machines	
3.1 Fluid Mechanics	• Fluid properties and their role in fluid motion, fluid statics including forces acting on plane and curved surfaces. • Kinematics and Dynamics of Fluid flow: Velocity and accelerations, stream lines, equation of continuity, irrotational and rotational flow, velocity potential, and stream functions. • Continuity, momentum, energy equation, Navier Stokes equation, Euler's equation of motion, application to fluid flow problems, pipe flow, sluice gates, and weirs.

3.2 Dimensional Analysis and Similitude	• Buckingham's Pi-theorem, dimensionless parameters.
3.3 Laminar Flow	• Laminar flow between parallel, stationary, and moving plates, flows through the tube.
3.4 Boundary layer	• Laminar and turbulent boundary layer on a flat plate, laminar sub-layer, smooth and rough boundaries, drag and lift. • Turbulent flow through pipes: Characteristics of turbulent flow, velocity distribution and variation of pipe friction factor, hydraulic grade line and total energy line.
3.5 Open channel flow	• Uniform and non-uniform flows, momentum and energy correction factors, specific energy and specific force, critical depth, rapidly varied flow, hydraulic jump, gradually varied flow, classification of surface profiles, control section, step method of integration of varied flow equations.
3.6 Hydraulic Machines and Hydropower	• Hydraulic turbines, types classification, Choice of turbines performance parameters, controls, characteristics, specific speed. • Principles of hydropower development.

Geotechnical Engineering

4. Geotechnical Engineering	• Soil Type and Structure —gradation and particle size distribution—consistency limits. • Water in soil —capillary and structural—effective stress and pore water pressure—permeability concept—field and laboratory determination of permeability—Seepage pressure—quick sand conditions—Shear strength determination—Mohr Coulomb concept. • Compaction of soil —Laboratory and field test. • Compressibility and consolidation concept — consolidation theory—consolidation settlement analysis. • Earth pressure theory and analysis for retaining walls, Application for sheet piles, and Braced excavation. • Bearing capacity of soil —approaches for analysis- Field tests—settlement analysis—stability of slope of earth walk. • Subsurface exploration of soils —methods • Foundation —Type and selection criteria for foundation of structures—Design criteria for foundation—Analysis of the distribution of stress for footings and pile—pile group action—pile load test. • Ground improvement techniques.
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UPSC Civil Engineering Syllabus for Paper 2

The UPSC Civil Engineering Syllabus for Paper 2 includes the topics like Construction Technology, Equipment, Planning and Management, Surveying and Transportation Engineering, and Hydrology. For a detailed subject description, refer to the table below.

UPSC Civil Engineering Syllabus for Paper 2	
Topic	Subtopic
Construction Technology, Equipment, Planning and Management	
1.1 Construction Technology (Engineering Materials)	- Physical properties of construction materials with respect to their use in construction—Stones, Bricks, and Tiles; Lime, Cement, different types of Mortars, and Concrete. - Specific use of ferro cement, fibre reinforced C. C., High strength concrete. - Timber; Properties defects—common preservation treatments. - Use and selection of materials for specific use like Low-Cost Housing, Mass Housing, High Rise Buildings.
1.2 Construction	- Masonry principles using Brick, stone, Blocks— construction detailing and strength characteristics. - Types of plastering, pointing, flooring, roofing, and construction features. - Common repairs in buildings. - Principle of functional planning of building for residents and specific use—Building code provisions. - Basic principles of detailed and approximate estimating —specification writing and rate analysis principles of valuation of real property. - Machinery for earthwork , concreting, and their specific uses—Factors affecting the selection of equipment—operating cost of equipment.
1.3 Construction Planning and Management	- Construction activity — schedules—organization for construction industry—Quality assurance principles. - Use Basic principle of network —analysis in form of CPM and PERT—their use in construction monitoring, Cost optimization, and resource allocation. - Basic principles of Economic analysis and methods. - Project profitability —Basic principles of Boot approach to financial planning-simple toll fixation criterions .
Surveying and Transportation Engineering	

2.1 Surveying	• Surveying : Common methods and instruments for distance and angle measurement for CE work—their use in plane table, traverse survey, leveling work, triangulation, contouring and topographical maps. • Basic principles of photogrammetry and remote sensing
2.2 Railways Engineering	• Permanent way—components, types, and their function-Functions and Design constituents of turn and crossing— Necessity of geometric design of track—Design of station and yards.
2.3 Highway Engineering	• Principles of Highway alignments —classification and geometrical design elements and standards for Roads. • Pavement structure for flexible and rigid pavements—Design principles and methodology of pavements. • Typical construction methods and standards of materials for stabilized soil, WBM, Bituminous works, and CC roads. • Surface and sub-surface drainage arrangements for roads—culvert structures. • Pavement distresses and strengthening by overlays. • Traffic surveys and their application in traffic planning—Typical design features for channelized, intersection rotary, etc.—signal designs—standard Traffic signs and markings.
Hydrology, Water Resources, and Engineering	
3.1 Hydrology	• Hydrological cycle, precipitation, evaporation, transpiration, infiltration, overland flow, hydrograph, flood frequency analyses, flood routing through a reservoir, channel flow routing—Muskingum method.
3.2 Groundwater flow	• Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, aquifers, aquitards, radial flow into a well under confined and unconfined conditions.
3.3 Water Resources Engineering	• Ground and surface water resources, single and multipurpose projects, storage capacity of reservoirs, reservoir losses, and reservoir sedimentation.

3.4 Irrigation Engineering	1. Water requirements of crops : consumptive use, duty and delta, irrigation methods and their efficiencies. 2. Canals : Distribution systems for canal irrigation, canal capacity, canal losses, alignment of main and distributary canals, most efficient section, lined canals, their design, regime theory, critical shear stress, and bed load. 3. Water logging: causes and control, salinity. 4. Canal structures: Design of head regulators, canal falls, aqueducts, metering flumes, and canal outlets. 5. Diversion head work : Principles and design of weirs on permeable and impermeable foundation, Khosla's theory, energy dissipation. 6. Storage works: Types of dams, design, principles of rigid gravity stability analysis. 7. Spillways: Spillway types, energy dissipation. 8. River training : Objectives of river training, methods of river training.
Environmental Engineering	
4.1 Water Supply	• Predicting demand for water, impurities of water and their significance, physical, chemical, and bacteriological analysis, waterborne diseases, and standards for potable water.
4.2 Intake of Water	• Water treatment: principles of coagulation, flocculation, and sedimentation; slow-, rapid-, pressure, filters; chlorination, softening, removal of taste, odour, and salinity.
4.3 Sewerage Systems	• Domestic and industrial wastes , store sewage—separate and combined systems, flow through sewers, design of sewers.
4.4 Sewage Characterisation	• BOD, COD , solids, dissolved oxygen, nitrogen, and TOC . Standards of disposal in normal water course and on land.
4.5 Sewage Treatment	• Working principles, units, chambers, sedimentation tank, trickling filters, oxidation ponds, activated sludge process, septic tank, disposal of sludge, recycling of wastewater.
4.6 Solid waste	• Collection and disposal in rural and urban contexts, management of long-term ill-effects.
Environmental pollution	

5. Environmental pollution	Sustainable development. Radioactive wastes and disposal. Environmental impact assessment for thermal power plants, mines, river valley projects. Air pollution. Pollution Control Acts.
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UPSC Civil Engineering Optional Syllabus PDF

The UPSC Civil Engineering Optional Syllabus consists of two papers — Paper 1 and Paper 2, each carrying a weightage of 250 marks. Both papers cover around 4 major subjects. Below is a direct link for UPSC Civil Engineering Optional Syllabus PDF for candidates who are opting for Civil Engineering as their optional subject.

UPSC Civil Engineering Syllabus 2026 Preparation Strategy

Preparing for the Civil Engineering Optional in the UPSC Mains requires a focused and well-planned strategy. Candidates who are opting as optional subject can refer the below discussed UPSC Civil Engineering Optional Syllabus Preparation Strategy:

- Carefully go through the syllabus for Paper 1 and Paper 2 to identify the key topics.
- Choose standard textbooks and reference materials as per the syllabus for in-depth preparation.
- Prepare concise notes, especially for important formulas and concepts for quick revision.
- Enhance your presentation and time management skills by solving previous year's papers and participating in a test series.
- Focus on problem-solving, particularly in subjects like Structural Analysis, Fluid Mechanics, and Transportation Engineering.
- Analyze your performance after each test and revise challenging topics.
- Allocate dedicated time for consistent revision and problem-solving to strengthen your understanding.
- Consider joining a Civil Engineering Optional coaching or seeking mentorship for expert feedback and guidance.
- Apply constructive feedback to improve your answer-writing skills and build a confident exam approach.

UPSC Civil Engineering Syllabus Optional Books

To effectively cover the Civil Engineering Optional Syllabus for the UPSC Mains, candidates should refer to the standard reference books which helps in building conceptual clarity. Below we have shared the list of UPSC Civil Engineering Optional Books that an appearing candidate who is opting for the Civil Engineering as the optional subject:

UPSC Civil Engineering Syllabus Optional Books	
Book	Author
Engineering Mechanics	Irvin Shames

Strength of Materials	Stephen Timoshenko
Strength of Materials	S. Ramamrutham
Intermediate Structural Analysis	CK Wang
Theory of Structures	S. Ramamrutham
Design of Steel Structures	S Duggal
Prestressed Concrete	N Krishna Raju
Handbook Of Reinforced Concrete Design	SN Sinha
Hydraulics and Fluid Mechanics Including Hydraulics Machines	Modi and Seth
Flow in Open Channels	K Subramanya
Basic and Applied Soil Mechanics	Gopal Ranjan and Rao
Soil Mechanics And Foundation Engineering	SK Garg
Construction, Planning, and Management	UK Srivastava
Irrigation Engineering	S.K. Garg
Building Construction	Arora and Bindra
Hydrology and Water Resources Engineering	S.K. Garg
Surveying	BC Punmia
Environmental Engineering (both volumes)	S.K. Garg

Other Related UPSC Optional Syllabus		
UPSC Commerce Optional Syllabus	UPSC Geography Optional Syllabus	UPSC Geology Optional Syllabus
UPSC History Optional Syllabus	UPSC Law Optional Syllabus	UPSC Maths Optional Syllabus
UPSC Medical Science Optional Syllabus	UPSC Philosophy Optional Syllabus	UPSC Physics Optional Syllabus
UPSC PSIR Optional Syllabus	UPSC Psychology Optional Syllabus	UPSC Sociology Optional Syllabus
UPSC Zoology Optional Syllabus	UPSC Economics Optional Syllabus	UPSC Agriculture Optional Syllabus
UPSC Anthropology Optional Syllabus	UPSC Botany Optional Syllabus	UPSC Chemistry Optional Syllabus
UPSC Civil Engineering Optional Syllabus	UPSC Management Optional Syllabus	UPSC Mechanical Engineering Optional Syllabus
UPSC Public Administration Optional Syllabus	UPSC Statistics Optional Syllabus	UPSC Electrical Engineering Optional Syllabus
UPSC Animal Husbandry & Veterinary Science Optional Syllabus		

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