

# UPSC CIVIL ENGINEERING OPTIONAL SYLLABUS

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### Syllabus PDF Download, Exam Pattern, Best Books & Preparation Tips

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UPSC Civil Engineering Optional Syllabus and Exam Pattern 2022 has been released, candidates can check the detailed UPSC Syllabus for Civil Engineering. The [UPSC exam](#) is conducted for the civil services aspiring candidates who wish to work for the nation. There are a total of two exams and one personal interview as the selection process. The UPSC main exam has 9 papers and out of those, two are optional papers. For the optional papers, candidates have 48 options to choose from. IAS Civil Engineering syllabus is one subject option the candidates have.

- The UPSC Exam 2022 is conducted by the Union Public Services Commission (UPSC). The selection process will be held in three stages namely the preliminary exam, main exam and the interview stage. Candidates will have to qualify the prelim exam to be eligible for the main exam.
- Civil Engineering Optional UPSC is one of the subject options which the candidates have. The subject is widely popular among the candidates who have deep knowledge in the subject and had this as one of their subjects in college or university.
- The subjects for the Civil Engineering UPSC Syllabus include topics such as Engineering mechanics, strength of materials, structural analysis, design of structures, geotechnical engineering and other topics. Check the UPSC Civil Engineering Syllabus below.
- The [IAS Main exam](#) will be of total 1750 marks and out of this 250 marks each are dedicated to the two optional subjects for which the candidates have to choose the subject of their choice.

The following article has been written for candidates' reference regarding the UPSC Civil Engineering Optional Syllabus. Interested candidates must read on to get other details about the Civil Engineering optional UPSC syllabus such as books, preparation tips, exam pattern etc.

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# UPSC Civil Engineering Syllabus 2022

It is necessary to go through the [IAS Civil Services Exam](#) syllabus which has been mentioned in detail in the UPSC notification. The Civil Engineering Optional UPSC Syllabus has been mentioned in detail in the official UPSC notification released on their website. Candidates can check the below mentioned civil engineering [Syllabus for UPSC](#) for the same:-

<b>Civil Engineering Optional Paper 1</b>	
<b>Engineering Mechanics</b>	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.
<b>Strength of Materials</b>	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, Beams of uniform strength.
	Deflection of beams: Mecauly's method, Mohr's Moment area method, Conjugate beam method, unit load method. Torsion of Shafts, Elastic stability of columns, Euler's, Rankine's and Secant formula.
<b>Structural Analysis</b>	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.
<b>Structural Design</b>	<b>Steel</b> 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 lacings.
<b>Design of Concrete and Structures</b>	Concept of mix 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 ground
	Prestressed Concrete : Methods and systems of prestressing, anchorages, Analysis and design of sections for flexure based on working stress, loss of prestress.
	Design of brick masonry as per I. S. Codes
<b>Fluid Mechanics</b>	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, weirs.
<b>Dimensional Analysis and Similitude</b>	Buckingham's Pi-theorem, dimensionless parameters.
<b>Laminar Flow</b>	Laminar flow between parallel, stationary and moving plates, flows through the tube.
<b>Boundary layer</b>	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.
<b>Open Channel Flow</b>	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.
<b>Hydraulic Machines and Hydropower</b>	Hydraulic turbines, types classification, Choice of turbines performance parameters, controls, characteristics, specific speed.
	Principles of hydropower development.
<b>Geotechnical Engineering</b>	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 distribution of stress for footings and pile—pile group action—pile load test.
	Ground improvement techniques
<b>Civil Engineering Optional Paper 2</b>	
<b>Construction Technology</b>	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.
<b>Construction</b>	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 selection of equipment—operating cost of equipment.
<b>Construction Planning and Management</b>	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.

<b>Surveying</b>	Common methods and instruments for distance and angle measurement for CE work—their use in plane table, traverse survey, levelling work, triangulation, contouring and topographical map.
	Basic principles of photogrammetry and remote sensing.
<b>Railways Engineering</b>	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.
<b>Highway Engineering</b>	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.
<b>Hydrology</b>	Hydrological cycle, precipitation, evaporation, transpiration, infiltration, overland flow, hydrograph, flood frequency analyses, flood routing through a reservoir, channel flow routing—Muskingum method.
<b>Groundwater flow</b>	Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, aquifers, aquitards, radial flow into a well under confined and unconfined conditions.
<b>Water Resources Engineering</b>	Ground and surface water resources, single and multipurpose projects, storage capacity of reservoirs, reservoir losses, reservoir sedimentation
<b>Irrigation Engineering</b>	Water requirements of crops : consumptive use, duty and delta, irrigation methods and their efficiencies.
	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, bed load.
	Water logging : causes and control, salinity.
	Canal structures : Design of head regulators, canal falls, aqueducts, metering flumes and canal outlets.
	Diversion head work : Principles and design of weirs on permeable and impermeable foundation, Khosla's theory, energy dissipation.
	Storage works : Types of dams, design, principles of rigid gravity stability analysis.
	Spillways : Spillway types, energy dissipation.
	River training : Objectives of river training, methods of river training.

<b>Water Supply</b>	Predicting demand for water, impurities of water and their significance, physical, chemical and bacteriological analysis, waterborne diseases, standards for potable water.
<b>Intake of Water</b>	Water treatment: principles of coagulation, flocculation and sedimentation; slow-, rapid-, pressure-, filters; chlorination, softening, removal of taste, odour and salinity
<b>Sewerage Systems</b>	Domestic and industrial wastes, store sewage—separate and combined systems, flow through sewers, design of sewers.
<b>Sewage Characterisation</b>	BOD, COD, solids, dissolved oxygen, nitrogen and TOC. Standards of disposal in normal water courses and on land.
<b>Sewage Treatment</b>	Working principles, units, chambers, sedimentation tank, trickling filters, oxidation ponds, activated sludge process, septic tank, disposal of sludge, recycling of waste water.
<b>Solid waste</b>	Collection and disposal in rural and urban contexts, management of long-term ill-effects.
<b>Environmental pollution</b>	Sustainable development. Radioactive wastes and disposal. Environmental impact assessment for thermal power plants, mines, river valley projects. Air pollution. Pollution control acts.

Candidates can take [UPSC IAS mock tests](#) here and strengthen their preparation.

## UPSC Civil Engineering Exam Pattern 2022

Candidates who will be appearing for the exam should know the detailed UPSC Civil Engineering Optional Syllabus beforehand. The prelim paper has a general studies paper and an aptitude test which is of total 400 marks.

UPSC mains exam will consist of several papers including the UPSC civil engineering syllabus papers. Check the exam pattern for the same below:-

Mains Papers	Subject	Marks
Paper VI	Optional Subject Paper-I	250
Paper VII	Optional Subject Paper-II	250
<b>Total</b>		<b>500</b>
<b>Time duration</b>		3 hours (180 minutes)

- The mains test is a total of 1750 marks and all the questions will be descriptive.
- There will be two qualifying papers (English and Indian Language) and other seven papers will be merit based papers
- UPSC civil engineering consists of two papers (paper I and paper II) in the UPSC Mains Exam. Each paper is of 250 marks with a total of 500 marks. These 2 optional papers are a part of UPSC Mains Examination that takes place after IAS Preliminary exam.

Check [UPSC Civil Services exam pattern](#) and marking scheme here for prelims and mains in detail to prepare for the IAS exam.

## How to Prepare for the UPSC Civil Engineering Syllabus?

Candidates who wish to get shortlisted for the interview round must be well-prepared for the mains exam. It is necessary that candidates not only complete studying the syllabus but are also done with their first-hand revision of IAS Civil Engineering Syllabus. Candidates must choose UPSC Civil Engineering Syllabus only if they are well-versed and have deep knowledge of the subject as there would be 500 marks for both the optional papers combined. Here are some preparation tips for the UPSC Civil Engineering Optional Subject which the candidates can incorporate so as to confirm their names on the [UPSC IAS Merit List](#):-

- It is basic to form brief and fresh notes for each subject. We must guarantee that for each subject notes should not add up to 15–16 pages, else the reason will be misplaced. Notes ought to contain vital concepts, equations, determinations and hypotheses particularly for paper 2 topics.
- Attempt solving a few questions of each theme so as to get it to the subject. Moreover, try solving as many past year questions as possible consisting of the UPSC Civil Engineering Syllabus to get the sort of questions UPSC inquires and imperative subjects. These PYQs ought to be our guiding light.
- Start attempting the best [UPSC Revision Test Series](#) with full length papers at detailed explanation for the same. You'll moreover almost learn the craftsmanship of selecting questions. The civil engineering paper will undoubtedly be lengthy.
- Last but not the least, [UPSC Previous Years Papers](#) will help the candidates get a fair idea of what all topics are important and what are the trends followed by the academic personals.

## Previous Year's Question Papers for UPSC Civil Engineering Optional Subject

So that candidates are fully prepared for the UPSC Civil Engineering Optional Syllabus, here are some previous years papers which will help the candidates get an actual interpretation of the examination and know about the type of questions which they can expect under the IAS Mains Civil Engineering section.

Optional Subject Papers	PDF Links
Civil Engineering Paper 1	<a href="#">Download PDF Here</a>
Civil Engineering Paper 2	<a href="#">Download PDF Here</a>

## Best Books for UPSC Civil Engineering Optional Subject 2022

Candidates must make beyond any doubt that the [UPSC Books](#) they will select for their planning must incorporate all the imperative points within the syllabus so that they don't miss out any critical theme. Here is a list of books to which the candidates can refer to for their preparation for UPSC civil engineering Optional Subject:-

Subject	Books	Author/ Publication
Civil Engineering	Engineering Mechanics	Shames
	Limit State Design	Ram Chandra
	Soil Mechanics and Foundation Engineering	A Singh and K R Arora
	Basic and applied Fluid Mechanics	Garde
	Steel Structure	L.S. Negi
	Soil Mechanics	K.R. Arora
	Engineering Hydrology	K. Subramanya
Ethics (General Studies Paper 4)	Ethics, Integrity and Aptitude for Civil Services Main Examination	Subba Rao and P.N. Roy Chaudary
Solved Papers	IAS General Studies Prelims Solved Papers	Vishal Publications
NCERT Books	NCERT BOOKS (6th to 12th standard)	NCERT

Check out some of the UPSC Optional Subject Syllabus pages for the Civil Services exam here:

- [UPSC Law Syllabus](#)     
 [UPSC Electrical Engineering Syllabus](#)     
 [UPSC English Literature Syllabus](#)  
[UPSC History Syllabus](#)     
 [UPSC Punjabi Literature Syllabus](#)     
 [UPSC Urdu Literature Syllabus](#)  
[UPSC Medical Science Syllabus](#)     
 [UPSC Philosophy Syllabus](#)     
 [UPSC Environmental Science Syllabus](#)

UPSCThe above article on UPSC Civil Engineering Optional Syllabus is intended to guide the candidates preparing for the exam. To boost your preparations, join the Testbook community right now! Testbook will help you prepare for the exams with the efficient notes, live classes, mock tests, test series, practice questions, and doubt clearing sessions all at the same place. Grab exciting offers available on the [Testbook app](#) at this moment and prepare for the UPSC Civil Engineering Optional Syllabus!