



Gujarat Public Service Commission

Advt.71/2020-21

Syllabus for the Competitive Examination

of

Gujarat Engineering Service (Civil)

Class-I and Class-II

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Scheme of Examination for Gujarat Engineering Services **(Civil) Class-I and Class-II**

Note: The medium of the examination shall be English. The medium of the Part I General Studies of Paper-1 shall be in Gujarati and English. Gujarati and English Papers in Main Exam shall be in respective Language only. In case of question of interpretation of syllabus, the interpretation of the English shall be final.

1. Preliminary Examination

Paper No.	Nature of Exam	Name of the paper	Time	Total Allotted Marks
1.	Objective	Part-I General Studies, Part-II Engineering Aptitude	2 Hours	100
2.		Civil Engineering	3 Hours	300
Total Marks				500

2. Main Examination

(For only those candidates who are declared qualified in Preliminary Examination)

Paper No.	Nature of Exam	Name of Paper	Time	Total Allotted Marks
1.	All Papers are Descriptive	Gujarati	2 Hours	100
2.		English	2 Hours	100
3.		Civil Engineering –I	3 Hours	200
4.		Civil Engineering-II	3 Hours	200
5.		Civil Engineering-III	3 Hours	200
Total Marks of written Examination				800
Interview (Only for the candidates who are declared qualified in Main Written Examination)				100
Total Marks to be considered for Final Selection				900

**Syllabus of Preliminary Examination for
Gujarat Engineering Service (Civil)
Class-I and Class-II**

Paper 1: General Studies and Engineering Aptitude (Preliminary)

Marks-200

No. of Questions-200

Time-2 Hours

Part-I General Studies

Medium: English/Gujarati

1. Indus valley Civilization: Features, Sites, Society, Cultural History, Art and Religion. Vedic age. Important Dynasties of India and Gujarat – Impact and Contribution, Important Policies, their administration, economy, society, religion, literature, arts and architecture. India's Freedom Movement, Revolutionaries in India and abroad. Achievements and administrative reforms of the rulers of princely states of Saurashtra, Kutchh and Gujarat.
2. Cultural Heritage of India and Gujarat: Art forms, Literature, Litterateurs, Sculpture and Architecture, Important organizations and institutions.
3. Geography of India and Gujarat: Physical, Social and Economic. General issues, legal aspect, policies and treaties on Environment Ecology, Bio-diversity and Climate Change. Forest and Wildlife Conservation in India. Environmental Hazards, Pollution, Carbon Emission, Global warming.
4. Indian Constitution: Evolution, features, Preamble, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Amendments, Significant Provisions and Basic Structure. Panchayati Raj, Public Policy and Governance. Rights Issues (Human rights, Women rights, SC/ST rights, Child rights) etc. Important Policies and Programmes of Central and State Governments. India's Foreign Policy: International Relations, Important Institutions, Agencies and Fora, their structure and mandate.

5. Indian Economy: Emergence and development of planning exercise in India, Performance, Dynamics, Challenges, New Initiatives, Reforms etc. by the State and Central Government. Important Events, Developments and Social Sector Initiatives. NITI Aayog: aims, constitution and functions. Social Audit. Regulatory framework for money and banking: concepts, structure and role.
6. Science and Technology: Relevance of Science & Technology to the day to day life; Institutions and Organization in India promoting integration of Science, Technology and Innovation, their activities and contribution; Contribution of Prominent Indian Scientists. Awareness in the field of Information and Communication Technology (ICT), Space Technology, Technology in Defence, Biotechnology, Nanotechnology etc. Energy policy of India, Nuclear Policy of India.
7. Current Events of Regional, National and International importance.

૧. સિંધુ ખીણની સભ્યતા: લાક્ષણિકતાઓ, સ્થળો, સમાજ, સાંસ્કૃતિક ઇતિહાસ, કળા અને ધર્મ. વેદિક યુગ. ભારત અને ગુજરાતના રાજવંશો-અસરો અને પ્રદાન, મહત્વની નીતિઓ, તેમનું વહીવટી તંત્ર, અર્થતંત્ર, સમાજ, ધર્મ, કલા, સ્થાપત્ય અને સાહિત્ય. ભારતની સ્વતંત્રતા માટેની ચળવળ, ભારત અને વિદેશમાં ભારતીય ક્રાંતિકારીઓ. સૌરાષ્ટ્ર, કચ્છ અને ગુજરાતના દેશી રાજ્યોના શાસકોના સુધારાવાદી પગલાઓ અને સિદ્ધિઓ.
૨. ભારત અને ગુજરાતનો સાંસ્કૃતિક વારસો : કળાસ્વરૂપો, સાહિત્ય, સાહિત્યકારો, શિલ્પ અને સ્થાપત્ય, મહત્વની સંસ્થાઓ અને સંગઠનો.
૩. ભારત અને ગુજરાતની ભૂગોળ : ભૌતિક, સામાજિક અને આર્થિક. પર્યાવરણની જાળવણી, બાયોડાયવર્સિટી (જૈવ વિવિધતા) અને ક્લાઈમેટ ચેંજ માટેના સામાન્ય મુદ્દાઓ, કાયદાકીય પાસાઓ, નીતિઓ અને સંધિઓ. ભારતમાં વન અને વન્યજીવન સંરક્ષણ. પર્યાવરણીય આપત્તિઓ, પ્રદૂષણ, કાર્બન ઉત્સર્જન અને વૈશ્વિક ગરમી (તાપવૃદ્ધિ).
૪. ભારતીય બંધારણ: ઉદ્ભવ અને વિકાસ, લાક્ષણિકતાઓ, આમુખ, મૂળભૂત અધિકારો અને ફરજો, માર્ગદર્શક સિદ્ધાંતો, બંધારણીય સુધારા, મહત્વની જોગવાઈઓ અને અંતર્નિહિત માળખું. પંચાયતી રાજ. જાહેર નીતિ અને શાસન. અધિકાર સંલગ્ન મુદ્દાઓ (માનવ અધિકાર, સ્ત્રીઓના અધિકાર, એસસી-એસટી અધિકારો, બાળકોના અધિકાર) ઇત્યાદી. કેન્દ્ર અને રાજ્ય સરકારની અગત્યની નીતિઓ અને કાર્યક્રમો. ભારતની

વિદેશનિતી: આંતરરાષ્ટ્રીય સંબંધો, મહત્વની સંસ્થાઓ, એજન્સી, વિવિધ સંગઠનો, તેમનું માળખું અને અધિકૃત આદેશ.

૫ ભારતીય અર્થતંત્ર: ભારતમાં આયોજનની કામગીરીનો ઉદભવ અને વિકાસ. કેન્દ્ર અને રાજ્ય સરકારની કામગીરી, ગતિશીલતા, પડકારો, નવી પહેલ, સુધારણા વગેરે. અગત્યની ઘટનાઓ, વિકાસ અને સામાજિક ક્ષેત્રની પહેલ. નીતિ આયોગ: ઉદ્દેશો, બંધારણ અને કાર્યો. સામાજિક ઓડિટ. નાણાં અને બેન્કિંગ માટે નિયમનકારી માળખું: વિભાવનાઓ, માળખું અને ભૂમિકા.

૬. વિજ્ઞાન અને ટેકનોલોજી; વિજ્ઞાન અને ટેકનોલોજીનું સ્વરૂપ અને ક્ષેત્ર, રોજબરોજના જીવનમાં વિજ્ઞાન અને ટેકનોલોજીની પ્રસ્તુતતા, ભારતમાં વિજ્ઞાન, ટેકનોલોજી અને ઇનોવેશન સાથે સંકળાયેલી વિવિધ સંસ્થાઓ, તેમની પ્રવૃત્તિઓ અને યોગદાન, પ્રસિધ્ધ ભારતીય વૈજ્ઞાનિકોનું યોગદાન. ઈન્ફર્મેશન અને કોમ્યુનિકેશન ટેકનોલોજી (આઇસીટી), અંતરીક્ષ/અવકાશ અને સંરક્ષણ સેવાઓમાં ટેકનોલોજી, બાયોટેકનોલોજી અને નેનોટેકનોલોજી વગેરે ક્ષેત્રોમાં જાગૃતિ, ભારતની ઉર્જા નીતિ અને પરમાણુ નીતિ.

૭. પ્રાદેશિક, રાષ્ટ્રીય અને આંતરરાષ્ટ્રીય કક્ષાની મહત્વની સાંપ્રત ઘટનાઓ

Part II: Engineering Aptitude

Medium: English

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

Paper 2: Civil Engineering (Preliminary)

Marks-300

No. of Questions-300

Medium- English

Time-3 Hours

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, Mohr's 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.

7. Building Construction

Brick and stone masonry walls, types of masonry, cavity walls, reinforced brickwork, building services, detailing of floors, roofs, ceilings, stairs, doors and windows, finishing, formwork, ground water control techniques , cofferdams, functional planning of building, orientations of buildings, low cost housings.

8. 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.

9. 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.

10. 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 aspects of wastes and Utilization by Civil Engineers.

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

11. 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 geo-synthetics.

(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.

12. **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.

13. **Transportation Engineering:**

Highways - Planning & construction methodology, Alignment and geometric design; Traffic Surveys and Controls; Principles of Flexible and Rigid pavements design.

Tunnelling - Alignment, methods of construction, disposal of muck, drainage, lighting and ventilation.

Bridges-Fundamentals of Bridge Engineering , Bridge Site Investigations and Planning, Bridge Hydrology, Standards of Loadings for Bridge Design, Different Types of Bridges, Bridge Superstructure, Bearings and Substructure Design, Design of Bridge Foundations, Bridge Approaches, River Training Work & Protection Work, Methods of Bridge Construction, Inspection, maintenance & Repair of Bridges, Testing of Bridges, Bridge Architecture.

14. **Current Trends and Recent Advancements in the field of Civil Engineering.**

**Syllabus of Main Examination for the
Gujarat Engineering Service (Civil)
Class-I and Class-II**

પ્રશ્નપત્ર-૧ : ગુજરાતી (મુખ્ય પરીક્ષા)

ગુણ-૧૦૦

માધ્યમ: ગુજરાતી

સમય-૨ કલાક

<u>અનુક્રમ</u>	<u>અભ્યાસક્રમની વિગત</u>	<u>ફાળવાયેલ ગુણ</u>
૧.	નિબંધ : ત્રણ પૈકી કોઈપણ એક (આશરે ૨૫૦ થી ૩૦૦ શબ્દોમાં) (વર્ણનાત્મક/વિશ્લેષણાત્મક/ ચિંતનાત્મક/સાંપ્રત સમસ્યા પર આધારિત).	૨૦
૨.	વિચાર વિસ્તાર : (બે પૈકી કોઈપણ એક) કાવ્યપંક્તિઓ કે ગદ્યસૂક્તિનો વિચારવિસ્તાર (આશરે ૧૦૦ શબ્દોમાં)	૧૦
૩.	સંક્ષેપીકરણ : આપેલા ગદ્યખંડમાંથી આશરે ૧/૩ ભાગમાં તમારા શબ્દોમાં સંક્ષેપ	૧૦
૪.	ગદ્યસમીક્ષા: આપેલા ગદ્યખંડના આધારે પૂછેલા પ્રશ્નોના જવાબ લખો.	૧૦
૫.	ચર્ચાપત્ર : (આશરે ૨૦૦ શબ્દોમાં) (વર્તમાનપત્રમાં પ્રજાના પ્રશ્નો/સાંપ્રત સમસ્યાઓ/વ્યક્તિગત અભિપ્રાય રજૂ કરતુ ચર્ચાપત્ર)	૧૦
૬.	અહેવાલ લેખન (આશરે ૨૦૦ શબ્દોમાં)	૧૦
૭.	દ્રશ્ય આલેખન : (ચિત્ર પરથી લખાણ આશરે ૧૫૦ શબ્દોમાં) (આલેખ/ચિત્ર/ફ્લો ચાર્ટ/સરખામણી પત્રક/આંકડાકીય માહિતી વગેરે)	૧૦
૮.	ભાષાંતર : અંગ્રેજીમાંથી ગુજરાતીમાં અનુવાદ	૧૦
૯.	ગુજરાતી વ્યાકરણ સૂચવ્યા મુજબ જવાબ લખો. (આ પ્રશ્નોમાં આંતરિક વિકલ્પો રહેશે નહીં.) ૧) રૂઢિપ્રયોગોના અર્થ અને તેનો વાક્યપ્રયોગ ૨) કહેવતોનો અર્થ ૩) સમાસનો વિગ્રહ કરી તેની ઓળખ	૧૦

- ૪) છંદ ઓળખાવો
- ૫) અલંકાર ઓળખાવો
- ૬) શબ્દસમૂહ માટે એક શબ્દ
- ૭) જોડણી શુદ્ધિ
- ૮) લેખન શુદ્ધિ/ભાષા શુદ્ધિ
- ૯) સંધિ – જોડો કે છોડો
- ૧૦) વાક્યરચનાના અંગો/ વાક્યના પ્રકાર/ વાક્ય પરિવર્તન

Paper 2: English (Main examination)

MARKS - 100

Medium: English

Time- 2 HOURS

<u>Serial</u> <u>No.</u>	<u>TYPE OF QUESTION</u>	<u>Marks to be</u> <u>allotted</u>
01	ESSAY (A minimum of 250 words and a maximum of 300 words): Choose any one topic from a list of five. (Descriptive/ analytical/ philosophical/ based on Current Affairs)	20
02	LETTER WRITING (in about 150 words): A formal letter expressing one's opinion about an issue. The issues can deal with daily office matters/ a problem that has occurred in the office/ an opinion in response to one sought by a ranked officer/issues pertaining to recent concern etc.	10
03	REPORT WRITING (in about 200 words): A report on an official function/event/field trip/survey etc.	10
04	WRITING ON VISUAL INFORMATION (in about 150 words) : A report on a graph/image/ flow chart/table of comparison/ simple statistical data etc.	10
05	FORMAL SPEECH (in about 150 words): A speech (in a formal style) that is to be read out in a formal function. This could be an inauguration speech, an educational seminar/conference, a formal ceremony of importance etc.	10
06	PRECIS WRITING: A precis in about 100 words for a 300-word passage.	10

07	READING COMPREHENSION:	10
	A reading passage of about 250 words to be given followed by short-answer type questions.	
08	ENGLISH GRAMMAR:	10
	a. Tenses	
	b. Voice	
	c. Narration (Direct-Indirect)	
	d. Transformation of sentences	
	e. Use of Articles and Determiners	
	f. Use of Prepositions	
	g. Use of Phrasal verbs	
	h. Use of idiomatic expressions	
	i. Administrative Glossary	
	j. Synonyms/Antonyms	
09.	TRANSLATION:	10
	Translation of a short passage (of about 150 words) from Gujarati to English.	

Paper 3: Civil Engineering-I (Mains)**Marks-200****Medium- English****Time: 3 hours****The structure of the question paper shall be as below:**

No of Questions	Marks Allotted to each Question	Word limit for each Answer	Total Marks
12	05	40 to 50 words	60
08	10	80 to 90 words	80
04	15	130 to 140 words	60

1. Building Materials:

Stone, Lime, Glass, Plastics, Steel, FRP, Ceramics, Aluminium, 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, Mohr's 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:

Design, Design process, Design philosophy. 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; Design of Masonry Structure.

RC Design: Loading standards as per I.S, distribution & flow of loads, lateral load due to wind as per IS: 875(Part - III), load combinations, guide lines for preparation of structural layout for building.

Earthquake Engineering: Fundamentals of Earthquake Vibrations of buildings, Earthquake Basics, Earthquake resistant Masonry features, Philosophy of earthquake resistant design, earthquake proof v/s earthquake resistant design, seismic structural configuration, Introduction to IS: 1893(Part I), IS: 875 (Part V). Seismic load: Seismic coefficient method – base shear and lateral force distribution along height. Introduction to Response spectrum, IS code provisions. Modal analysis of building frame, Lateral Loads on Buildings, Lateral Load Distribution, Ductile Detailing, Introduction to soil liquefaction, structural controls & Seismic strengthening.

Paper 4: Civil Engineering-II (Mains)**Marks-200****Medium- English****Time: 3 hours****The structure of the question paper shall be as below:**

No of Questions	Marks Allotted to each Question	Word limit for each Answer	Total Marks
12	05	40 to 50 words	60
08	10	80 to 90 words	80
04	15	130 to 140 words	60

1. Building Construction

General Principles of Building, Brick and stone masonry walls, types of masonry, cavity walls, reinforced brickwork, building services, detailing of floors, roofs, ceilings, stairs, doors and windows, finishing, formwork, functional planning of building, orientations of buildings, low cost housings.

2. Flow of Fluids, Hydraulic Machines and Hydro Power:**(a) Fluid Mechanics, Open Channel Flow, Pipe Flow:**

Fluid properties; Dimensional Analysis and Modelling; 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.

3. Hydrology and Water Resources and Irrigation Engineering:

Hydrological cycle, measurement and analysis of rainfall, 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;, 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. Introduction to use of remote sensing and GIS technologies in study of irrigated areas. Land grading and field layout, Design aspects in border strip method, check basin method and furrow irrigation. Irrigation systems: Types, principles, design, operation, maintenance and problems associated with it. Irrigation efficiencies, Scheduling of irrigation. Irrigation water quality. Design of Hydraulic Structures: Elements of Dam engineering, Embankment dam engineering, Concrete dam engineering, Dam outlet works, Drop structures.

4. 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 aspects of wastes and Utilization by Civil Engineers.

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

5. Current Trends and Recent Advancements in the field of Civil Engineering.

Paper 5: Civil Engineering-III (Mains)**Marks-200****Medium- English****Time: 3 hours****The structure of the question paper shall be as below:**

No of Questions	Marks Allotted to each Question	Word limit for each Answer	Total Marks
12	05	40 to 50 words	60
08	10	80 to 90 words	80
04	15	130 to 140 words	60

1. 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; Market Survey and Analysis of Rates of various types of works; Abstracting and Billing, Tendering Process and Contract Management, Quality Control, Productivity, Operation Cost; Land acquisition; Labour safety and welfare.

2. 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, Stability of slopes, Earth pressure theories and stress distribution in soil; Properties and uses of geo-synthetics, Basics of foundation, Subsurface Investigation, Bearing capacity of shallow foundation, Pile foundations,

(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, ground water control techniques, cofferdams.

3. **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; Photogrammetric; Remote sensing concepts; Survey Layout for culverts, canals, bridges, road/railway alignment and buildings, Setting out of Curves. Application of Geoinformatics in Civil Engineering: Land use and land cover mapping, Transportation studies, crop inventory studies, ground water mapping, urban growth studies, flood plain mapping, waste land mapping, Waste disposal facility in urban areas and disaster management.

(b) Geology: Basic knowledge of Engineering geology & its application in projects. Types of structures and classification and their effect on Civil Engineering projects and Geological mapping.

4. **Transportation Engineering:**

Highways - Planning & construction methodology, Alignment and geometric design; Traffic Surveys and Controls; Principles of Flexible and Rigid pavements design.

Tunnelling - Alignment, methods of construction, disposal of muck, drainage, lighting and ventilation.

Bridges - Fundamentals of Bridge Engineering, Bridge Site Investigations and Planning, Bridge Hydrology, Standards of Loadings for Bridge Design, Different Types of Bridges, Bridge Superstructure, Bearings and Substructure Design, Design of Bridge Foundations, Bridge Approaches, River Training Work & Protection Work, Methods of Bridge Construction, Inspection, maintenance & Repair of Bridges, Testing of Bridges, Bridge Architecture.

5. **Repairs and Rehabilitation of Structures**

Repair Strategies, Serviceability and Durability of Concrete, Materials and Techniques for Repair, Repairs, Rehabilitation and Retrofitting of Structures, Demolition Techniques.