

SYLLABUS FOR TECHNICAL QUESTIONS IN CIVIL ENGINEERING

[100 Marks: 50 Questions]

Structural Engineering

Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass; Free Vibrations of undamped SDOF system.

Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, Transformation of stress; buckling of column, combined and direct bending stresses.

Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.

Construction Materials and Management: Construction Materials: Structural Steel – Composition, material properties and behaviour; Concrete - Constituents, mix design, short-term and long-term properties. Construction Management: Types of construction projects; Project planning and network analysis - PERT and CPM; Cost estimation.

Concrete Structures: Working stress and Limit state design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete beams.

Steel Structures: Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Concept of plastic analysis - beams and frames.

Geotechnical Engineering

Soil Mechanics: Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Seepage through soils – two - dimensional flow, flow nets, uplift pressure, piping, capillarity, seepage force; Principle of effective stress and quicksand condition; Compaction of soils; One dimensional consolidation, time rate of consolidation; Shear Strength, Mohr's circle, effective and total shear strength parameters, Stress-Strain characteristics of clays and sand; Stress paths.

Foundation Engineering: Sub-surface investigations - Drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes – Finite and infinite slopes, Bishop's method; Stress distribution in soils Boussinesq's theory; Pressure bulbs, Shallow foundations – Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations – dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, negative skin friction.

Water Resources Engineering

Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Potential flow, Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth; Concept of lift and drag.

Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles.

Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface runoff models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's Law.

Irrigation: Types of irrigation systems and methods; Crop water requirements - Duty, delta, evapo-transpiration; Gravity Dams and Spillways; Lined and unlined canals, Design of weirs on permeable foundation; cross drainage structures.

Environmental Engineering

Water and Waste Water Quality and Treatment: Basics of water quality standards – Physical, chemical and biological parameters; Water quality index; Unit processes and operations; Water requirement; Water distribution system; Drinking water treatment, Sewerage system design, quantity of domestic wastewater, primary and secondary treatment. Effluent discharge standards; Sludge disposal; Reuse of treated sewage for different applications.

Air Pollution: Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air quality Index and limits. Municipal Solid Wastes: Characteristics, generation, collection

and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

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Transportation Engineering

Transportation Infrastructure: Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments.

Geometric design of railway Track – Speed and Cant.

Concept of airport runway length, calculations and corrections; taxiway and exit taxiway design

Highway Pavements: Highway materials - desirable properties and tests; Desirable properties of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible and rigid pavement using IRC codes

Traffic Engineering: Traffic studies on flow and speed, peak hour factor, accident study, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Traffic signs; Signal design by Webster's method; Types of intersections; Highway capacity.

Geomatics Engineering

Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves.

Photogrammetry and Remote Sensing - Scale, flying height; Basics of remote sensing and GIS.

Test of Reasoning [15 Marks: 15 Questions]

Logical Reasoning

Statement and Conclusion, Statement and Assumptions, Statement and Arguments, Statement and Course of Action, Cause and Effect, Analytical Decision Making

Seating Arrangement

Circular Arrangement, Linear Arrangement (Single and Double Rows), Square and Rectangular Arrangements, Floor Puzzles, Box-Based Puzzles

Puzzles

Scheduling Puzzles, Blood Relations-Based Puzzles, Ranking and Order Puzzles, Age-Based Puzzles, Day/Month-Based Puzzles

Blood Relations

Family Tree and Relationship Chains, Coded Relationships.

Syllogisms

Categorical Syllogisms, Advanced Syllogisms (Reverse Syllogisms), Venn Diagram Applications in Syllogisms

Coding-Decoding

Alphanumeric Coding, Letter Coding, Number Coding, Symbol-Based Coding

Direction Sense Test

Cardinal Directions (North, South, East, West), Complex Directions with Turning and Distances

Quantitative Aptitude [15 Marks: 15 Questions]

Data Interpretation

- **Tabular Data Interpretation:** Interpretation of tables and data sets.
- **Line Graph:** Data representation and analysis using line graphs.
- **Bar Graph:** Interpretation of data presented in bar graphs.
- **Pie Chart:** Calculations based on data presented in pie charts.
- **Caselets:** Data interpretation with paragraph-based information.
- **Mixed Graphs:** Combining different types of graphs in a single question.
- **Radar Graph (Spider Web):** Less common but may appear.

Number Series

- **Missing Number Series:** Finding the missing term in a given series.
- **Wrong Number Series:** Identifying the incorrect term in a series.

Simplification and Approximation

- Questions based on basic mathematical operations to simplify expressions.
- Approximation questions require choosing the closest answer.

Quadratic Equations

- Solving quadratic equations to find roots.
- Comparison of roots between two quadratic equations.

Data Sufficiency

- Problems with multiple statements where you determine if the given data is sufficient to answer the question.

Arithmetic Topics

- **Percentages:** Basic calculations, profit and loss, and discounts.
- **Ratio and Proportion:** Problems based on direct and inverse proportions.
- **Average:** Calculating averages for different scenarios.
- **Simple Interest and Compound Interest:** Interest calculations over time.
- **Profit and Loss:** Calculation of gains, losses, and discounts.
- **Time and Work:** Problems involving work completion, efficiency, and combined efforts.
- **Time, Speed, and Distance:** Calculations with speed, distance, and time; includes boats and trains.
- **Mixtures and Alligations:** Mixing solutions, costs, and ratios.
- **Mensuration:** Basic geometry, areas, volumes of shapes, and perimeters.
- **Partnerships:** Sharing profits based on investments.
- **Probability:** Basic probability calculations and event outcomes.
- **Permutation and Combination:** Arrangement and selection problems.

Mathematical Inequalities

- Problems requiring the comparison of quantities using inequalities.

Miscellaneous Word Problems

- These cover real-life scenarios and test conceptual understanding.

General Awareness [15 Marks: 15 Questions]

Current Affairs

- Recent events of national and international importance
- Awards and Honors (Padma Awards, Nobel Prizes, etc.)
- Sports (major tournaments, winners, records)
- Government schemes and policies
- Important Summits and Conferences
- Economic and Banking Awareness (recent developments in banking and finance)
- Important Days and Themes

Indian History

- **Ancient History:** Indus Valley Civilization, Vedic Period, Maurya and Gupta Empires
- **Medieval History:** Delhi Sultanate, Mughal Empire, Bhakti and Sufi Movements
- **Modern History:** British Rule, Revolt of 1857, Indian National Movement, Independence

Geography

- **Physical Geography:** Landforms, Atmosphere, Climate, and Natural Vegetation
- **Indian Geography:** Rivers, Mountains, Plateaus, Deserts, Soil, Forests
- **World Geography:** Continents, Countries, Capitals, and prominent physical features

Indian Polity and Constitution

- **Constitutional Framework:** Preamble, Fundamental Rights and Duties, Directive Principles
- **Union and State Government:** Structure, Roles, and Functions of Executive, Legislature, and Judiciary
- **Important Amendments and Articles:** Key constitutional amendments and articles
- **Political System:** Panchayati Raj, Election Commission, Local Governance

Economics and Finance

- **Basic Concepts:** Micro and Macro Economics, Demand and Supply, National Income
- **Indian Economy:** Economic Reforms, Planning in India, Economic Terminology
- **Banking and Finance:** RBI, Money Market, Inflation, Economic Policies
- **Budget and Fiscal Policies:** Key points from the Union Budget and Economic Surveys

Science and Technology

- **Biology:** Human Body, Health and Diseases, Important Biological Terms
- **Chemistry:** Basics of Elements and Compounds, Acids and Bases, Metals and Non-Metals
- **Physics:** Laws of Motion, Work and Energy, Heat, Light, Sound, Electricity and Magnetism
- **Computer Awareness:** Basic terminology, Networking, Internet, Hardware and Software
- **Inventions and Discoveries:** Key scientific and technological developments

Environment and Ecology

- **Ecological Concepts:** Biodiversity, Conservation, Ecosystem, Food Chain
- **Environmental Issues:** Pollution, Climate Change, Global Warming, Renewable and Non-Renewable Resources
- **Important Organizations and Conventions:** UNEP, Kyoto Protocol, Paris Agreement

General Knowledge

- **Important Dams, Rivers, and National Parks**
- **Important Organizations:** UN, WHO, WTO, IMF, World Bank
- **Space Research:** Recent developments in ISRO, NASA, and space missions.

English Language [15 Marks: 15 Questions]

Reading Comprehension

- Passage comprehension with questions on main ideas, themes, and details
- Inference-based questions
- Vocabulary questions (synonyms, antonyms) based on the passage
- Tone of the passage

Grammar and Vocabulary

- **Error Spotting:** Identifying grammatical errors in sentences
- **Sentence Correction:** Correcting grammatically incorrect sentences
- **Fill in the Blanks:** Choosing the right words to complete sentences (single and double fill-in-the-blanks)
- **Cloze Test:** Passage with blanks where you choose the most suitable word for each blank
- **Phrase Replacement:** Replacing phrases in sentences to make them grammatically correct

Sentence Rearrangement (Para Jumbles)

- Arranging jumbled sentences in the correct order to form a coherent paragraph
- Identifying the correct opening and closing sentences in a set of jumbled sentences

Synonyms and Antonyms

- Questions based on commonly used synonyms and antonyms
- Word replacement questions to test vocabulary strength

Idioms and Phrases

- Understanding and applying the meaning of commonly used idioms and phrases
- Questions based on idiomatic usage in sentences

Word Association and Usage

- **Word Pairing:** Identifying relationships between pairs of words
- **Homonyms and Homophones:** Recognizing words that sound similar but have different meanings
- **Spell Check:** Questions based on identifying misspelled words

Sentence Completion and Paragraph Completion

- Choosing the most appropriate sentence or word to complete a paragraph
- Filling gaps in sentences to make logical and grammatically correct statements

Verbal Ability

- Questions based on verbal reasoning and critical thinking
- Questions on understanding of sentence meaning and logical progression

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