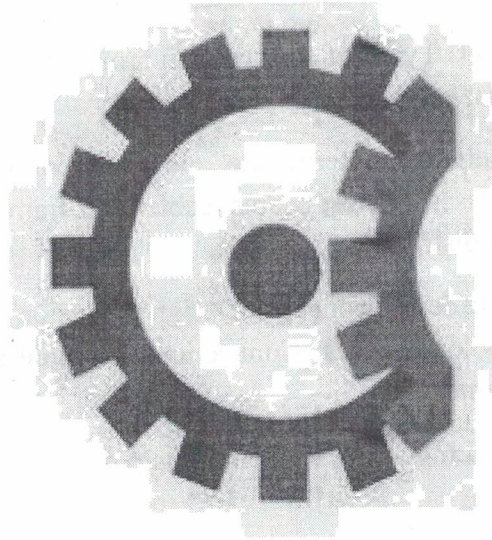


PhD ENTRANCE TEST

SYLLABUS

2024-2025

DEPARTMENT OF CIVIL ENGINEERING



**TULSIRAMJI GAIKWAD-PATIL COLLEGE OF
ENGINEERING AND TECHNOLOGY. MOHAGAON,
WARDHA ROAD, NAGPUR, 441108 MAHARASHTRA, INDIA.**

**Civil Engineering Department, Tulsiramji Gaikwad-Patil College of
Engineering and Technology, Mohagaon, Wardha Road, Nagpur, 441108
Maharashtra, INDIA.**

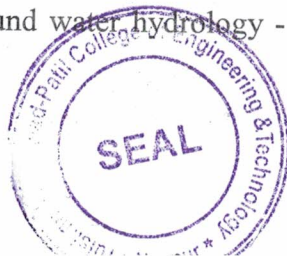
Syllabus for PhD Entrance Test (PET): Civil Engineering

Module 1: Structural Engineering

- a) **Engineering Mechanics:** System of forces, free-body diagrams, equilibrium equations; internal forces in structures; Frictions and its applications.
- b) **Solid Mechanics:** Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; simple bending theory, flexural and shear stresses, Uniform torsion, Transformation of stress; buckling of column, combined and direct bending stresses.
- c) **Construction Materials:** Construction Materials: Structural Steel-Composition, material properties and behaviour; Concrete Constituents, mix design, short term and long-term properties.
- d) **Construction Management:** Types of construction projects; Project planning and network analysis PERT and CPM; Cost estimation.
- e) **Structural Analysis:** Statically determinate and indeterminate structures, Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods.
- f) **Steel Structures:** Limit state design concepts; Design of tension and compression members, beams and beam-columns, column bases; Connections - simple and eccentric, Concept of plastic analysis beams and frames.
- g) **Concrete Structures:** Working stress and Limit state design concepts; Design of beams, slabs, columns.

Module 2: Water Resources Engineering

- a) **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.
- b) **Hydraulics:** Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulics; Channel Hydraulics-Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles.
- c) **Hydrology:** Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's Law.



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

Module 3: Geotechnical Engineering

a) 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 clay and sand, stress path.

b) 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 later all loading, pile group efficiency, negative skin friction.

Module 4: Environmental Engineering

a) 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.

b) Air Pollution: Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air quality Index and limits.

c) Solid Wastes Management: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

Module 5: Transportation Engineering

a) Highway Engineering: Classification of roads based on the different criteria, Highway alignment and engineering surveys, Geometric design of highways: cross-sectional elements, sight distances, horizontal and vertical alignments. 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.

b) Traffic Engineering: Traffic studies on flow, speed, travel time delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis, statistical analysis of traffic data; Control



devices, signal design by Webster's method: Types of intersections: Highway capacity and level of service of rural highways and urban roads

c) **Railway Engineering:** Geometric design of railway Track: Engineering surveys for track alignment, Speed and Cant, Railways for urban transportation.

d) **Airport Engineering:** Airport planning, topographical features, air traffic characteristics, factors affecting airport site selection, Apron, Hanger, Concept of airport runway length, calculations and corrections; taxiway and exit taxiway design.

Module 6: Surveying

a) **Principle of Surveying:** 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.

b) **Photogrammetry and Remote Sensing:** Scale, flying height; Basics of remote sensing and GIS.

Module 7: Engineering Maths

a) **Linear Algebra:** Matrix algebra, Systems of linear equations; Eigen values and Eigen vectors.

b) **Calculus:** Functions of single variable; Limit, continuity and differentiability; Mean value theorems, local maxima and minima; Taylor series

c) **Probability and Statistics:** Sampling theorems; Conditional probability, Descriptive Statistics-Mean, median, mode and standard deviation. Linear regression.

d) **Numerical Methods:** Error analysis. Numerical solutions of linear and non-linear algebraic equations; Newton's and Lagrange polynomials. Runge Kutta Method, Gauss elimination method

03/03/25
2025
Dr. Aasif Baig
(Member)

03/03/25
S. Abhyankar
Dr. Snehal Abhyankar
(Member)

03/03/25
Dr. Amey Khedikar
(Chairman)

05/03/25
Principal
Tulsiramji Gaikwad-Patil
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