

**UNIVERSITY OF MUMBAI**



**Syllabus for PET- 2020 Examination**  
*for*  
**Civil Engineering**

**FACULTY OF SCIENCE & TECHNOLOGY**

# University of Mumbai

## Syllabus for PhD PET July 2020

### Subject: Civil Engineering

#### **Section A: Research Methodology and General Awareness**

##### **1.0 Introduction and Basic Research Concepts**

- 1.1 Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology
- 1.2 Need of Research in Business and Social Sciences
- 1.3 Objectives of Research
- 1.4 Issues and Problems in Research
- 1.5 Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical

##### **2.0 Types of Research**

- 2.1 Basic Research
- 2.2 Applied Research
- 2.3 Descriptive Research
- 2.4 Analytical Research
- 2.5 Empirical Research
- 2.6 Qualitative and Quantitative Approaches

##### **3.0 Research Design and Sample Design**

- 3.1 Research Design – Meaning, Types and Significance
- 3.2 Sample Design – Meaning and Significance Essentials of a good sampling, Stages in Sample design
- 3.3 Sample Design Sampling methods/techniques Sampling Errors

##### **4.0 Research Methodology**

- 4.1 Meaning of Research Methodology
- 4.2 Stages in Scientific Research Process:
  - a. Identification and Selection of Research Problem
  - b. Formulation of Research Problem
  - c. Review of Literature
  - d. Formulation of Hypothesis
  - e. Formulation of research Design

- f. Sample Design
- g. Data Collection
- h. Data Analysis
- i. Hypothesis testing and Interpretation of Data
- j. Preparation of Research Report

## **5.0 Formulating Research Problem**

- 5.1** Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis

## **6.0 Outcome of Research**

- 6.1** Preparation of the report on conclusion reached
- 6.2** Validity Testing & Ethical Issues
- 6.3** Suggestions and Recommendation

## **References:**

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C.R., 1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2<sup>nd</sup>ed), Singapore, Pearson Education

## **Instructions:**

- PET Examination will be of Total Marks = 100
- Candidates can attempt any one specialisation as mentioned in the A or B or C as given below:

### **Section B: Civil Engineering**

#### **Specialisation A: Structural and Geotechnical Engineering**

**Advanced Structural Analysis:** Theories of Failure, Beams on Elastic Foundation, Analysis of Deep Beams

**Structural Dynamics and Earthquake Engineering:** Undamped vibration of SDOF /MDOF System, Orthogonally principle. Earthquake Responses on structures. I.S. code provisions for seismic analysis of buildings.

**Finite Element Method:** Concept of an element, various element shapes displacement models, foundation of finite element method using principle of virtual displacements, derivation of element stiffness and loads for pin-jointed bar element, beam element, triangular plate element (in-plane forces), rectangular plate element (in-plane forces).

**Analysis and Design of Plate and Shell:** Small Deflection Theory for Laterally Loaded Thin Rectangular Plates, Symmetrical Bending of Circular Plates, Potential Energy Principle, Shear Deformation Theory, Membrane Theories of Shell

**Geotechnical Engineering and Advance Foundation Engineering:** Consolidation, Shear Strength, Estimation of Stresses in Soils, Bearing Capacity of Soils, Pile Foundation, Ground Improvement, Soil Dynamics

#### **Specialisation B: Fluid Mechanics, Hydraulics, Water Resources Engineering and Environmental Engineering**

**Fluid Mechanics:** Properties of Fluids, Pressures and Head, Static Forces on Surface and Buoyancy, Fluid Kinematics and Dynamics, Flow measurement, Ideal Fluid flow, Compressible

flow, Laminar and Turbulent flow through pipes, Boundary Layer Theory, Dimensional analysis, Pipe flow analysis.

**Hydraulics:** Impulse momentum principle, Hydraulic Machines, Flow through open Channels, Gradually Varied Steady Flow, Spatially Varied Flow, Sediment Transport.

**Hydrology:** water-budget equation, Abstractions from precipitation, Runoff, Hydrographs, Flood and flood routing, Groundwater and well hydrology, Surface, Subsurface investigations, Ground water pollution, Water withdrawals and uses, Ground water conservation and artificial recharge, soil and water conservation

**Hydraulic Structures:** Design principles for gravity and earthen dams, Distribution systems, Diversion works, Geographical Information System, Watershed and watershed management, Water resources economics, planning and management.

**Water and Waste Water:** Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution. Sewage and sewerage treatment, Characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, effluent discharge standards. Domestic wastewater treatment, Characteristics of domestic wastewater, primary and secondary treatment. Unit operations and unit processes of domestic wastewater, sludge disposal.

**Air Pollution:** Sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.

**Municipal Solid Waste:** Characteristics, generation, collection and transportation of solid wastes, Solid waste management: reuse/ recycle energy recovery, treatment and disposal.

**Noise Pollution:** Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

## **Specialisation C: Transportation Engineering, Construction Engineering and Construction Management**

**Transportation Infrastructure:** Highway alignment and engineering surveys, Geometric design of highways. Railways for urban transportation-Engineering surveys for track alignment Obligatory

Points-Conventional and modern methods, remote sensing and GIS. Water transportation system, harbours docks, port facilities. Airport planning, topographical geographical features, air traffic characteristics, factors affecting airport site selection.

**Highway Pavements:** Classification of roads based on the different criteria, Geometric Design, Materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements using IRC. Highway Construction, drainage, rehabilitation and maintenance

**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; Microscopic and macroscopic parameters of traffic flow, Control devices, signal design by Webster's method; Types of intersections and channelization; Highway capacity and level of service of rural highways and urban roads.

**Construction Engineering:** Construction Equipment, Standard and special equipment, Owning and operating cost, depreciation costs, economic life, sources of construction equipment, factors affecting selection of construction equipment, Earthmoving equipment's, Pile driving equipment: types, pile driving hammers, Tunnelling, Selection of alignment, methods of tunnelling in soft soils and in hard rock, ventilation of tunnels.

Ground Improvement Techniques: Sand drains, stone columns etc. Use of geotextiles and, chemicals, diaphragm wall, rock anchors, foundation grouting etc.

**Construction Management:** Objectives and functions of construction management, Stages of planning, Bar Charts, Networks: CPM and PERT, Material Management, ABC analysis, E.O.Q., Resources Allocation Methods- Resource levelling resource smoothing. Human Resource Management: Manpower planning, recruitment, Selection training, performance evaluation of worker etc.

## References Books:

1. Structural Analysis: DevdasMenon, Narosa Publishing House.
2. Theory of Structures: S. Ramamrutham, Dhanpatrai and Sons, Delhi
3. Irrigation and Water Power Engineering: B.C. Punmia, PandeB.B.Lal, A.K Jain. Laxmi Publications Pvt, Ltd. New Delhi.
4. Soil Mechanics & Foundation Engineering: V. N. S. Murthy, Saitech Publications

5. Soil Mechanics & Foundation Engineering: K. R. Arora, Stard Publishers Distributors, New Delhi.
6. Soil Mechanics & Foundation Engineering: B.C. Punimia, Laxmi Publications
7. Hydraulics and Fluid mechanics: Dr. P.N. Modi and Dr. S.M. Seth, Standard Book House, Delhi.
8. Environmental Engineering (Vol.I & Vol. II)- Sewage Disposal and Air Pollution Engineering: S. K. Garg, Khanna Publication
9. Irrigation Engineering and Hydraulic Structures: S.K. Ukarande, Ane Books Pvt. Ltd.ISBN,9789383656899.
10. Irrigation Engineering and Hydraulics Structures: S. K. Garg, Khanna Publishers. Delhi.
11. Highway Engineering: Khanna, S.K., Justo, C. E. G. and Veeraraghavan A; NemChand and Bros.
12. Principles of Transportation and Highway Engineering, Rao, G.V.; Tata McGraw Hill Publishing House Pvt. Ltd., New Delhi.
13. Concrete Technology Theory and Practice: Shetty M.S., S. Chand
14. Concrete Technology: Gambhir M.L., Tata McGraw Hill, New Delhi.
15. Construction Project planning & Scheduling By Charles Patrick, Pearson 3.
16. Construction Project Management Theory & practice --- Kumar Neeraj Jha, Pearson
17. Construction management Fundamentals by Knutson, Schexnayder, Fiori, Mayo, Tata McGraw Hill,

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