

SPPU

According to New Revised Credit System Syllabus

**Second Year Degree Course In
CIVIL ENGINEERING (Sem - II)**


Concrete Technology

Includes

- Sample Ques. Papers for Theory Exams (30 Marks)

**Dr. M. N. BAJAD
P. R. MINDE**

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 **NIRALI**
PRAKASHAN
ADVANCEMENT OF KNOWLEDGE

A TEXT BOOK OF

CONCRETE TECHNOLOGY

FOR
SEMESTER – II

SECOND YEAR DEGREE COURSE IN CIVIL ENGINEERING

Strictly According to New Revised Credit System Syllabus
of Savitribai Phule Pune University

(w.e.f June 2016)

Dr. M. N. BAJAD

M.E. (Structural), Ph. D.,
Research Scholar (NIT), Gold Medalist
Associate Professor, Civil Engg. Deptt.
Sinhgad College of Engineering,
Vadgoan (Bk.), PUNE – 41

P. R. MINDE

B.E. (Civil), M.E. (C & M),
Assistant Professor, Civil Engg. Deptt.
JSPM's Pd. Vasantdada Patil Institute of Technology
Bavdhan, Pune – 21

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PRAKASHAN
ADVANCEMENT OF KNOWLEDGE

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Email : bharatsavla@yahoo.com

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PREFACE

It gives us great pleasure in publishing this text book on "**Concrete Technology**" for the students of Second Year Degree Course in Civil Engineering. This book is strictly written according to **New Revised Credit System Syllabus** of Savitribai Phule Pune University (2015 Pattern).

As per the policy of the University, Engineering Syllabi is revised every five years. Last revision was in the year 2012. New revision is coming little earlier, as university has introduced **Online System of Examination** from year 2012.

As per the **New Credit System**, the **Online Examinations** Phase-I will be conducted based on First & Second Units and Phase II on Third & Fourth Units. The **Online** examinations will have objective types of questions with multiple choices. End Sem. Theory Examination will be based on all the six units and that will be conducted in traditional way and the Theory Course will have 4 credits.

Concrete is one of the important materials of construction of Civil Engineering. It is difficult to point out another material of construction which is as versatile as concrete. It is the material of choice where Strength, Performance, Durability, Impermeability, Fire Resistance and Abrasion resistance are required. It is so closely associated now with every human activity that it touches every human being in his day-to-day living.

Questions from previous papers of the University of Pune are included at the end of each chapter. It is our objective to keep the presentation systematic, consistent, intensive and clear presentation of concept through explanatory notes and figures. So we are sure that this book will cater for all your needs for this subject.

Main feature of this book is, **Complete Coverage** of the New Credit System Syllabus with large number of **Worked (Solved) Examples and Exercises**.

We have given Separate Book of Multiple Choice Questions (MCQ's) which will be very useful to the students especially for Online Examinations.

We take this opportunity to express our sincere thanks to Shri. Dineshbhai Furia, Shri. Jignesh Furia, Mrs. Nirali Verma and Shri. M. P. Munde and entire team of Nirali Prakashan namely Mrs. Deepali Lachake (Co-ordinator), who really have taken keen interest and untiring efforts in publishing this text.

The advice and suggestions of our esteemed readers to improve the text are most welcomed, and will be highly appreciated.

Pune

Authors

SYLLABUS

Unit I : Introduction to Concrete as a Construction Material: General Perspective

Ingredients of Concrete.

(08 Hrs)

(a) Cement : Manufacture of Portland cement, basic chemistry of cement, hydration of cement, classification of cement, types of cement, tests on cement: field tests & laboratory tests.

(b) Aggregate and water : Different classifications, Fine aggregate, coarse aggregate, mechanical properties, physical properties, deleterious materials, soundness, alkali-aggregate reaction, sieve analysis: Fineness and gradation tests on aggregates, artificial and recycled aggregate, mixing water, curing water, tests on water.

Admixtures: functions, classification, types: mineral and chemical, IS: specifications (9103 and 456), compatibility of admixtures.

Unit II: Properties, Production and testing of fresh concrete

(08Hrs)

(a) Fresh concrete: Workability : factors affecting workability, cohesion and segregation, Bleeding, Laitance, mixing, handling, placing and compaction of concrete, Influence of temperature, maturity rule.

(b) Tests of fresh concrete : Workability by Slump cone, Compaction factor, Vee Bee consistometer and flow table test, Marsh cone test.

Unit III : Properties and tests on hardened concrete and Special Concretes

(08Hrs)

(a) Hardened concrete : Strength of concrete, factors affecting strength, micro-cracking and stress-strain relationship, other strength properties, relation between tensile and compression strength, impact strength, abrasion resistance, elasticity and creep, shrinkage and swelling.

(b) Testing of hardened concrete : Compression test on cube and cylinder, flexural test, indirect tensile strength, core test. Non destructive testing: Rebound hammer, Ultrasonic pulse velocity, Pullout test and Impact echo test, Rebar locator.

Unit IV : Concreting equipments, techniques and Special concretes

(08Hrs)

(a) Introduction to concrete related equipments : Batching plants, hauling, pumps, Types of concrete mixers: Tilting, Non tilting and Reversible drum mixer, Types of vibrators Special concreting techniques: pumping of concrete, under water concreting, ready mix concrete, roller compacted concrete Cold weather concreting, hot weather concreting.

(b) Special concretes : Light weight concrete, Cellular light weight concrete-Form concrete and autoclave C.L.C, polymer concrete, types of fibers, fiber reinforced Concrete, high density concrete, self compacting concrete and applications. Ferrocement: Definition, Basic concepts in forming ferrocement composites, Methods of casting.

Unit V : Concrete Mix Design

(08Hrs)

Concepts of Mix Design, Factors for proportioning of concrete. Factors to be considered, Statistical quality control, Laboratory trial mixes and guidelines to improve mix , methods of Mix Design for M25 and above grades by IS (10262-2009, 456) and DOE methods with and without fly ash, Demonstration and application of concrete mix design software.

Unit VI: Deterioration and repairs.

(08Hrs)

(a) Deterioration : Permeability and durability, chemical attack and sulphate attack by seawater, acid attack, chloride attack, carbonation of concrete and its determine ation, corrosion of reinforcement.

(b) Repairs : Symptoms and diagnosis of distress, evaluation of cracks, selection of repair procedure, repair of defects, common types of repairs, shotcrete, Introduction of retrofitting by using FRP, Corrosion monitoring techniques & preventive measures.

CONTENTS

Unit I – Introduction to Concrete as a Construction Material: General

Perspective

Chapter 1 : Cement	1.1-1.40
1.1 Introduction: Concrete as Construction Material	1.1
1.2 Cement	1.1
1.3 Manufacture of Portland Cement	1.2
1.3.1 Mixing of Raw Materials	1.2
1.3.2 Wet Process	1.2
1.3.3 Dry Process	1.4
1.3.4 Burning	1.5
1.3.5 Grinding	1.6
1.4 Chemical Composition of cement	1.6
1.5 Bogue's Compounds	1.8
1.6 Hydration of Cement	1.10
1.7 Classification of Cement	1.11
1.8 Types of Cements	1.11
1.8.1 Ordinary Portland Cement (OPC)	1.12
1.8.2 Rapid Hardening Portland Cement (RHPC) (IS : 8041 – 1990)	1.12
1.8.3 Extra-rapid Hardening Portland Cement	1.13
1.8.4 Low Heat Portland Cement (IS : 12600 – 1989)	1.13
1.8.5 Sulphate Resisting Cement (IS : 12330 – 1988)	1.13
1.8.6 Quick Setting Cement	1.14
1.8.7 High Strength Cement	1.14
1.8.8 High Alumina Cement (IS : 6452 – 1989)	1.14
1.8.9 White Cement (IS : 8042 – 1989)	1.14
1.8.10 Coloured Cement	1.14
1.8.11 Hydrophobic Cement (IS : 8043 – 1978)	1.15
1.8.12 Masonry Cement (IS : 3466 – 1988)	1.15
1.8.13 Expansive Cement	1.15
1.8.14 Super-Sulphate Cement	1.16
1.8.15 Blended Cement	1.16
1.8.16 Portland Pozzolana Cement	1.17
1.8.17 Blast Furnace Slag Portland Cement	1.17
1.9 Tests on Cement	1.18
1.9.1 Fineness Test	1.19
1.9.2 Standard Consistency Test	1.24

1.9.3	Setting Time Test	1.27
1.9.4	Soundness Test	1.30
1.9.5	Compressive Strength Test	1.32
1.9.6	Density Test	1.35
1.9.7	Heat of Hydration Test	1.36
1.9.8	Specific Gravity	1.36
•	Review Questions	1.38
•	University Questions	1.39
Chapter 2 : Aggregate		2.1-2.20
2.1	Introduction	2.1
2.2	Good Qualities of an Ideal Aggregate	2.1
2.3	Classification of Aggregates	2.2
2.3.1	Classification According to Geological Origin	2.2
2.3.2	Classification According to Grain Size	2.3
2.3.3	Classification According to Shape	2.3
2.3.4	Classification According to Surface Texture	2.5
2.3.5	Classification Based on Unit Weight	2.5
2.4	Mechanical Properties of Aggregates	2.6
2.5	Physical Properties of Aggregates	2.6
2.6	Deleterious Materials	2.7
2.6.1	Organic Impurities	2.8
2.6.2	Surface Coatings	2.8
2.6.3	Salt Contamination	2.8
2.6.4	Unsound Particles	2.8
2.7	Soundness of Aggregate	2.9
2.8	Bulking of Fine Aggregate	2.9
2.9	Alkali-Aggregate Reaction	2.10
2.10	Sieve Analysis	2.12
2.11	Fineness Modulus	2.15
2.12	Recycled Aggregate	2.16
•	Review Questions	2.18
•	University Questions	2.20
Chapter 3 : Water and Admixture		3.1-3.3.18
3.1	Water	3.1
3.2	Mixing Water	3.1
3.3	Curing water	3.1
3.4	Tests on Water	3.2
3.5	Impurities in Mixing Water	3.3
3.6	Admixture	3.4

3.7	functions of Admixture	3.5
3.8	Classification of Admixtures	3.5
3.8.1	Platicizers	3.7
3.8.2	Superplasticizers	3.8
3.8.3	Accelerators	3.9
3.8.4	Retarders	3.9
3.8.5	Grouting Admixtures	3.10
3.8.6	Air Entraining Admixtures	3.10
3.8.7	Air Detraining Agents	3.11
3.8.8	Gas Forming Admixtures	3.12
3.8.9	Expansion Producing Admixtures	3.12
3.8.10	Water Proofing Admixtures	3.12
3.8.11	Corrosion Inhibiting Admixtures	3.13
3.8.12	Fungicidal, Germicidal and Insecticidal Admixture	3.13
3.8.13	Bonding Admixture	3.13
3.8.14	Mineral Admixtures or Pozzolanic Admixtures	3.14
3.8.15	Colouring Admixtures	3.16
3.8.16	Workability Admixtures	3.16
3.9	IS specifications	3.17
3.10	Compatibility of Admixture	3.18
•	review Questions	3.18
•	University questions	3.18

Unit II – Properties, Production and Testing of Fresh Concrete

Chapter 4 : Properties, Production and Testing of Fresh Concrete 4.1-4.34

4.1	Introduction	4.1
4.2	Properties of Fresh Concrete	4.1
4.3	Workability	4.2
4.4	Factors Affecting Workability	4.2
4.5	Cohesion and Segregation	4.5
4.5.1	Cohesion	4.5
4.5.2	Segregation	4.5
4.6	Bleeding	4.6
4.7	Laitance	4.7
4.8	Workability Tests	4.7
4.9	Types of Stump	4.9
4.10	Flow / Flow Table Test	4.11
4.11	Compacting Factor Test	4.12
4.12	VEE-BEE Consistometer Test	4.14
4.13	Various Operations Involved In Concreting From Mixing To Finishing	4.16
4.14	Under Water Concreting	4.28

4.15	Influence of Temperature on Properties of Concrete	4.30
4.16	Maturity of Concrete	4.30
4.17	Marsh Cone Test	4.31
•	Review Questions	4.33
•	University Questions	4.34

Unit III – Properties and Tests on Hardened Concrete and Special Concretes

Chapter 5 : Properties of Hardened Concrete 5.1-5.18

5.1	Hardened Concrete	5.1
5.2	Strength of Concrete	5.1
5.2.1	Compressive Strength	5.1
5.3	Factors Affecting Strength of Concrete	5.1
5.3	Microcracking	5.7
5.4	Stress-Strain Relation	5.7
5.5	Other Strengths of Concrete	5.8
5.5.1	Flexural Strength	5.8
5.5.2	Tensile Strength	5.8
5.5.3	Impact Strength	5.8
5.6	Relation Between Compressive and Tensile Strength	5.9
5.7	Resistance to Abrasion	5.10
5.8	Elastic Property of Concrete	5.10
5.9	Creep	5.12
5.9.1	Factors Affecting Creep	5.14
5.10	Shrinkage	5.15
5.10.1	Factors Affecting Shrinkage	5.17
5.11	Swelling	5.18
•	Review Questions	5.18
•	University Questions	5.18

Chapter 6 : Tests on an Hardened Concrete 6.1-6.18

6.1	Introduction	6.1
6.2	Flexural Strength of Concrete	6.5
6.3	Indirect Tension Test	6.7
6.4	Core Test	6.8
6.5	Non-Destructive Testing (NDT)	6.8
6.5.1	Rebound Hammer Test	6.9
6.5.2	Ultrasonic Pulse Velocity Method	6.11
6.5.3	Pull-Out Test	6.13
6.5.4	Impact Echo Test	6.14
6.6	Rebar Locator Test	6.16
•	Review Questions	6.17
•	University Questions	6.18

Unit IV – Concreting Equipments, Techniques and Special Concretes

Chapter 7 : Concreting Equipments and Concreting Techniques		7.1-7.30
7.1	Introduction: Batching Plants	7.1
7.2	Typical Structure of Batching Plant	7.2
7.3	Hauling Equipment	7.3
7.3.1	Trucks	7.3
7.3.2	Dump Trucks	7.4
7.3.3	Dumpers	7.4
7.3.4	Elevators and Conveyors	7.5
7.3.5	Trailers	7.6
7.4	Concrete Pumps	7.6
7.4.1	Type of Pumping Units	7.7
7.5	concrete Mixers	7.8
7.5.1	Tilting Mixers	7.9
7.5.2	Non-Tilting Mixers	7.10
7.5.3	Reversible Mixers	7.10
7.6	In-Transit mixer or Concrete Transportation Truck	7.11
7.7	Vibrators	7.12
7.7.1	Internal or Needle Type Vibrator	7.13
7.7.2	Shutter form or External Type Vibrator	7.13
7.7.3	Surface or Pan Type Vibrators	7.14
7.7.4	Table Vibrator	7.14
7.8	Pumping of Concrete	7.15
7.9	Under Water Concreting	7.18
7.9.1	Tremie Method	7.18
7.9.2	Bucket Placing	7.19
7.9.3	Placing in Bags	7.20
7.10	Ready-Mixed Concrete	7.20
7.11	Roller Compacted Concrete	7.23
7.12	Cold Weather Concreting	7.24
7.13	Hot Weather Concreting	7.27
•	Review Questions	7.29
•	University Questions	7.30
Chapter 8 : Special Concretes		8.1-8.22
8.1	Introduction	8.1
8.2	Light-Weight Concrete	8.1
8.2.1	Advantages of Light-Weight Concretes	8.1
8.2.2	Light-Weight Aggregate	8.2
8.2.3	No-Fines Concrete	8.3
8.2.4	Cellular Light-Weight Concrete (CLC)	8.4
8.2.5	Autoclaved Aerated Concrete (AAC)	8.4
8.3	Polymer Concrete	8.6

8.3.1	Types of Polymer Concrete	8.6
8.4	Fibre Reinforced Concrete	8.6
8.4.1	Types of Fibre	8.7
8.4.2	Factors Affecting Properties of Fibre Reinforced Concrete	8.9
8.4.3	Applications of Fibre Reinforced Concrete	8.13
8.5	High Density Concrete	8.13
8.5.1	Heavy Weight Aggregate	8.14
8.5.2	Shielding Ability of Concrete	8.14
8.6	Self Compacting Concrete and Applications	8.16
8.6.1	Materials Used in Self Compacting Concrete	8.16
8.6.2	Advantages of Self Compacting Concrete	8.16
8.6.3	Disadvantages of Self Compacting Concrete	8.17
8.6.4	Applications	8.17
8.7	Ferrocement	8.17
8.7.1	Basic Concepts in Forming Ferrocement in Composites	8.18
8.7.2	Casting Techniques (Methods of Construction of Ferrocement)	8.19
•	Review Questions	8.21
•	University Questions	8.22

Unit V – Concrete Mix Design

Chapter 9 : Concrete Mix Design 9.1-9.54

9.1	Introduction	9.1
9.1.1	Requirements of Concrete Mix Design	9.1
9.2	Factors Influencing the Choice of Mix Design	9.1
9.3	Basic Assumptions	9.4
9.4	Statistical Quality Control	9.4
9.5	Trial Mixes	9.20
9.6	Methods of Mix-Design	9.20
9.6.1	Indian Standard Method (IS Method)	9.21
9.7	Department of Environment (DOE) Method	9.37
9.8	MixSim - The Concrete Mix Design Software	9.45
•	review Questions	9.46
•	University Questions	9.47

Unit VI – Deterioration and Repairs

Chapter 10 : Deterioration and Repairs 10.1-10.40

10.1	Deterioration : Introduction	10.1
10.2	Permeability of Concrete	10.1
10.2.1	Factors Affecting Permeability	10.2
10.2.2	Measurement of Permeability In the Laboratory	10.4
10.2.3	The Permeability can be Reduced by	10.4
10.3	Durability of Concrete	10.4
10.4	Chemical Attack	10.5

10.4.1	Sulphate Attack	10.6
10.4.2	Chlorides Attack	10.7
10.4.3	Acid Attack	10.7
10.4.4	Attack by Sea Water	10.8
10.5	Carbonation of Concrete	10.9
10.6	Corrosion of Reinforcement	10.11
10.6.1	Mechanism of Electro-Chemical Corrosion	10.12
10.7	Introduction: Repairs	10.14
10.8	Symptoms and Diagnosis of Distress	10.15
10.9	Factors Contributing Cracks in the Concrete and Prevention Of Cracks	10.15
10.10	Evaluation of Cracks	10.17
10.10.1	Visual Inspection	10.17
10.9.2	Non-Destructive Testing	10.18
10.10	Selection of Repair Procedures	10.18
10.11	Repair of Cracks	10.19
10.11.1	Preparation of Surface	10.19
10.11.2	Application of Repair Material	10.20
10.11.2	(a) Ordinary Procedures	10.20
10.11.2	(b) Special Procedures	10.23
10.11.3	Curing of Repair Work	10.24
10.12	Common Types of Repairs	10.24
10.12.1	Sealing of Cracks	10.24
10.12.1	Flexible Sealing	10.25
10.12.3	Providing Additional Steel	10.26
10.12.4	Stitching of Cracks	10.27
10.12.5	Repair by Jacketing	10.28
10.12.6	Autogenous Healing	10.30
10.13	Shotcrete	10.31
10.13.1	Types of Shotcreting	10.31
10.13.2	Rebound	10.33
10.13.3	Properties of Shotcretes	10.33
10.13.4	Advantages with Shotcretes	10.33
10.13.5	Disadvantages with Shotcretes	10.33
10.13.6	Applications	10.34
10.14	Retrofitting by using FRP	10.34
10.15	Corrosion Monitoring Techniques	10.35
10.16	Corrosion Preventive Measures	10.36
•	Review Questions	10.37
•	University Questions	10.39



1.1 INTRODUCTION: CONCRETE AS CONSTRUCTION MATERIAL

- Concrete is a composite material formed by the combination of cement, aggregate and water, in a particular proportion.
- Concrete is an ancient material of construction, first used during the Roman Empire.
- Concrete is one of the most versatile, durable, and cost effective building materials known to man.

1.2 CEMENT

- Cement is a binding material used in building and civil engineering construction.
- Cement is used to bind structural members for construction of buildings, pavements, bridges, tunnels, roads and highways etc.
- Cements is finely ground grey powders that, when mixed with water it set to a hard mass.
- Cement is the most important and costliest ingredient of concrete.
- It was invented by Joseph Aspdin of U. K. in 1824. He named it Portland Cement because the hardened concrete made out of the cement, fine aggregates, coarse aggregates and water in definite proportions resembled the natural stone occurring at portland in England.
- India started cement production in 1904. The first cement factory was installed in Tamil Nadu
- Ordinary Portland Cement (OPC) is the most common cement used in the construction because of the abundance and low cost to produce it.

1.3 MANUFACTURE OF PORTLAND CEMENT

The manufacture of cement involves 3 distinct operations as shown in Fig. 1.1.

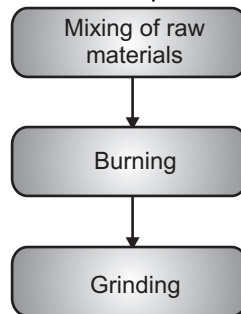


Fig. 1.1

1.3.1 Mixing of Raw Materials

- The raw materials used in the manufacture of cement are: (a) Argillaceous materials – consisting of silicates of alumina in the form of clays and shales, and (b) Calcareous materials – in the form of limestone, chalk and marl, which is a mixture of clay and calcium carbonate. These materials are mixed thoroughly.
- The mixing of raw materials can be done in **two ways, “wet” and “dry” processes**, depending upon whether the mixing and grinding of raw materials is done in wet or dry conditions

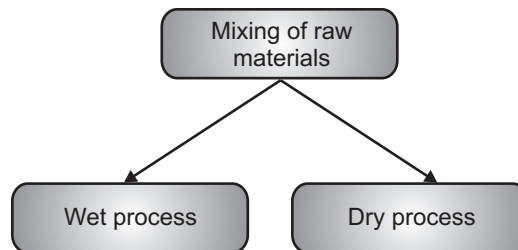


Fig. 1.2

1.3.2 Wet Process

► [Dec., 12, 13, May 14]

- In the earlier part of the century, the wet process was popular for the manufacture of cement because of the possibility of more precise control in the mixing of raw materials.
- In the wet process, the calcareous materials such as limestone are crushed and stored in silos or storage tanks.
- The argillaceous material such as clay is thoroughly mixed with water in a wash mill. The washed clay is then stored in basins.
- Now, the crushed limestone from the silos and wet clay from basins are mixed together in a wet grinding mill to make slurry.
- The slurry is led to the correcting basin where it is constantly stirred. At this stage, the chemical composition of the slurry is tested and adjusted as necessary.

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