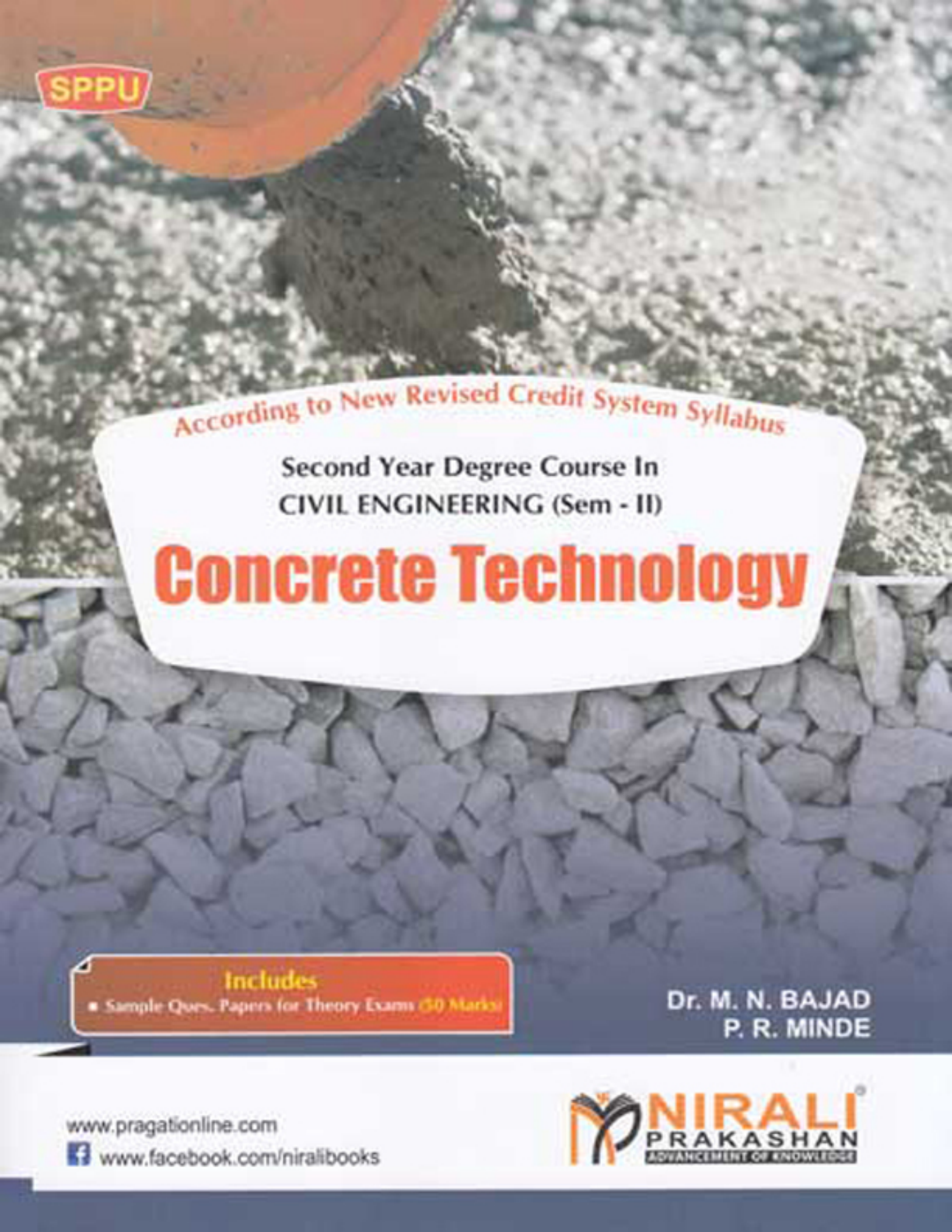

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According to New Revised Credit System Syllabus

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

Concrete Technology

Includes
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FOR
SEMESTER – II

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Strictly According to New Revised Credit System Syllabus of Savitribai Phule Pune University
(w.e.f June 2016)

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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

Unit IV – Concreting Equipments, Techniques and Special Concretes

Unit I

Chapter 1
CEMENT

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.

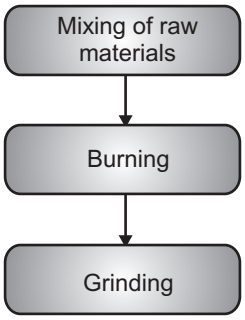

Fig. 1.1

1.3.1 Mixing of Raw Materials

- The raw materials used in the manufacture of cement are: (a) Agrillaceous 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

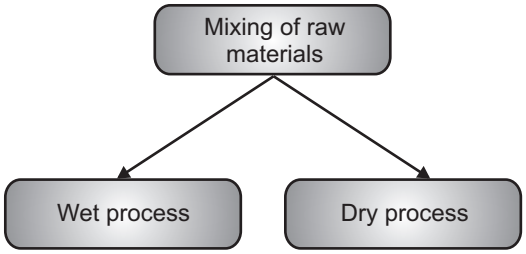

Fig. 1.2

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 algrillaceous 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.

Concrete Technology

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