CONTENTS

CHAPTER 1 - INTRODUCTION TO CONCRETE TECHNOLOGY **1-19**

- **1.1 History and Evolution of Concrete**
- **1.2 Role of Concrete in Modern Infrastructure**
- **1.3 Conventional vs Modern Concrete**
- **1.4 Sustainability Issues in Cement and Concrete Production**
- **1.5 Future Trends in Concrete Technology**

CHAPTER 2 - CEMENT AND SUPPLEMENTARY CEMENTITIOUS MATERIALS **20-42**

- **2.1 Composition and Chemistry of Cement**
- **2.2 Manufacturing Process of Cement**
- **2.3 Hydration of Cement**
- **2.4 Supplementary Cementitious Materials (SCMs)**
- **2.5 Environmental Impact and Sustainable Cement Alternatives**

CHAPTER 3 - AGGREGATES FOR CONCRETE **43-61**

- **3.1 Introduction to Aggregates**
- **3.2 Types of Aggregates (Natural, Artificial, Recycled)**
- **3.3 Aggregate Grading and Sieve Analysis**
- **3.4 Physical and Mechanical Properties of Aggregates**
- **3.5 Chemical Properties of Aggregates and Alkali–Aggregate Reaction (AAR)**

CHAPTER 4 - CHEMICAL ADMIXTURES **62-76**

- **4.1 Introduction to Chemical Admixtures**
- **4.2 Plasticizers and Superplasticizers**
- **4.3 Accelerators and Retarders**
- **4.4 Air-Entraining Admixtures**
- **4.5 Mineral Admixtures**

CHAPTER 5 - FRESH CONCRETE PROPERTIES **77-93**

- **5.1 Workability of Concrete**
- **5.2 Consistency of Concrete**
- **5.3 Segregation of Concrete**
- **5.4 Bleeding of Concrete**
- **5.5 Setting Time of Concrete**

CHAPTER 6 - HARDENED CONCRETE PROPERTIES **94-104**

- **6.1 Introduction**
- **6.2 Tensile Strength of Concrete**
- **6.3 Flexural Strength of Concrete**
- **6.4 Modulus of Elasticity of Concrete**
- **6.5 Shrinkage of Concrete**

CHAPTER 7 - CONCRETE MIX DESIGN **105-117**

- **7.1 Objectives of Concrete Mix Design**
- **7.2 Factors Affecting Mix Design**
- **7.3 Principles of Mix Proportioning**
- **7.4 High-Strength Concrete Mix Design**
- **7.5 Quality Control in Batching Plants**

CHAPTER 8 - DURABILITY OF CONCRETE **118-129**

- **8.1 Factors Affecting Durability**
- **8.2 Mechanisms of Concrete Deterioration**
- **8.3 Methods to Improve Durability**
- **8.4 Testing of Durability**
- **8.5 Durability Design Guidelines**

CHAPTER 9 - HIGH-PERFORMANCE AND SPECIAL CONCRETES **130-139**

- **9.1 Definition and Characteristics**
- **9.2 Types of High-Performance and Special Concretes**
- **9.3 Materials for Special Concretes**
- **9.4 Applications of High-Performance and Special Concretes**

CHAPTER 10 - ADVANCED CONCRETE MATERIALS **140-149**

- **10.1 Introduction**
- **10.2 Ultra-High-Performance Concrete (UHPC)**
- **10.3 Self-Healing Concrete**
- **10.4 Geopolymer Concrete**
- **10.5 Lightweight and Foam Concrete**

CHAPTER 11 - MODERN CONSTRUCTION TECHNIQUES **150-167**

- **11.1 Introduction**
- **11.2 Prefabrication and Modular Construction**
- **11.3 Advanced Formwork Systems**
- **11.4 3D Concrete Printing (Additive Manufacturing)**

11.5 Automation and Robotics in Construction
11.6 Sustainable Construction Techniques

CHAPTER 12 - TESTING, REPAIR AND REHABILITATION **168-183**
12.1 Introduction to Structural Evaluation
12.2 Non-Destructive Testing (NDT) Methods
12.3 Destructive Testing Methods
12.4 Repair Techniques for Concrete Structures
12.5 Rehabilitation and Strengthening of Concrete Structures