



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

SPECIAL CONCRETES

I Semester: ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTE04	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		
Prerequisite: Concrete Technology								

I. COURSE OVERVIEW:

The Special Concretes course provides an in-depth understanding of advanced concrete types and their applications beyond conventional mixes. It covers various specialized concretes, including high-strength, self-compacting, fiber-reinforced, lightweight, mass, shotcrete, preplaced aggregate, underwater anti-washout, and micro-concretes. The course emphasizes the properties, mix design, construction techniques, and quality control measures required for these concretes under diverse environmental and structural conditions. It also highlights practical applications in high-rise buildings, massive infrastructure, underwater structures, and extreme weather conditions, equipping students and professionals with the knowledge to select and apply suitable concrete types for complex engineering projects.

II. COURSE OBJECTIVES:

The student will try to learn:

- I. The design, manufacturing, and applications of high-strength, high-performance, and special concretes.
- II. Skills to design concrete mixes using BIS and international methods for different construction needs.
- III. Formwork materials, design requirements, erection, maintenance, and failure prevention techniques.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

- CO 1 Identify and select suitable concrete-making materials based on BIS specifications and project requirements.
- CO 2 Conduct and interpret tests on fresh and hardened concrete to evaluate workability, strength, and durability.
- CO 3 Understand the microstructure and mechanical properties of High Strength Concrete (HSC) and Ultra High Strength Concrete (UHSC).
- CO 4 Design and optimize high-strength, high-performance, and special concretes for specific applications.
- CO 5 Prepare detailed concrete mix designs using IS 10262:2019 and DOE methods to meet quality targets.
- CO 6 Design safe, efficient formwork systems and apply best practices for installation, reshoring, and removal.

IV. COURSE CONTENT:

MODULE-I: Concrete Making Materials (09)

Cement – Bogus Compounds, Hydration Process, Types of Cement, Aggregates – Gradation Charts, Combined Aggregate, Alkali Silica Reaction, Admixtures - Chemical and Mineral Admixtures. Bureau of Indian Standards (BIS) Provisions.

MODULE-II: Fresh and Hardened Concrete (09)

Fresh Concrete – workability tests on Concrete, Setting Times of Fresh Concrete, Segregation and bleeding. Hardened Concrete: Abrams Law, Gel space ratios, Maturity concept, Stress strain Behaviour, Creep and Shrinkage, Durability Tests on Concrete, Non-Destructive Testing of Concrete. BIS Provisions.

MODULE-III: High Strength Concrete and High-Performance Concrete (9)

High Strength Concrete – Microstructure, Manufacturing and Properties, Design of HSC Using Erintroy Shaklok method, Ultra High Strength Concrete.

High Performance Concrete –Requirements and Properties of High-Performance Concrete, Design Considerations. BIS Provisions.

MODULE-IV: Special Concretes and Mix Design (10)

Special Concretes: Self Compacting concrete, Polymer Concrete, Fibre Reinforced Concrete, Reactive Powder Concrete, Requirements and Guidelines, Advantages and Applications.

Concrete Mix Design: Quality Control, Quality Assurance, Quality Audit, Mix Design Method, BIS Method IS.10262 – 2019 Concrete Mix proportion guidelines. DOE Method, Light Weight Concrete, Self-Compacting Concrete.

MODULE-V: Form work (8)

Form work, materials, structural requests, form work systems, connections, specifications, design of form work, shores, removal for forms, shores, reshoring, failure of form work.

V. TEXTBOOKS:

1. A. M. Neville, “*Properties of Concrete*”, ELBS publications, 2012.
2. A. K. Santha kumar, “*Concrete Technology*”, Oxford Press, 2006.
3. M. S. Shetty, “*Concrete Technology*”, S. Chand & Co, 2006.

VI. REFERENCE BOOKS:

1. Rajat Siddique, “*Special Structural Concretes*”, Galgotia Publications, 2004.
2. N. Krishna Raju, “*Design of Concrete Mixes*”, CBS Publications, 1996.
3. P. K. Mehta, “*Concrete: Microstructure*”, ICI, Chennai, 2007

VII. ELECTRONICS RESOURCES:

1. <http://nptel.ac.in/courses/112104160/3>
2. <http://nptel.ac.in/downloads/112104160/>
3. <https://books.google.co.in/books?id=DXOsGoqtiggC&printsec=frontcover#v=onepage&q&f=false>.
4. https://www.researchgate.net/publication/273059503_Introduction_to_Structural_Health_Monitoring

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation