

Materials, Testing & Evaluation

01CI2401

Objective of the Course:

- To acquaint the students for exploring the materials, its properties, intrinsic nature and its application in preparing cement Concrete.
- To understand the influence of various factors effecting the strength and durability of Concrete.
- To understand the basic behavior of concrete under application of various loading conditions and surrounding environment.
- To illustrate the concrete mix design process based on properties of material as per various national and international standards.
- To demonstrate the various advanced concrete and advanced testing techniques used in field.

Credits Earned: 3

Course Outcomes

After completion of this course, students will be able to

- Understand features of special concrete and concreting methods
- Analyze the engineering properties of Civil Engineering materials like aggregate, cement, concrete, steel, wood, plastic, paints, and other materials.
- Identify, Describe and carry out lab tests relevant to use of civil engineering materials on site.
- Ensure the quality of engineering materials on site.
- Interpret the behavior of concrete in its fresh and hardened state with respect to its strength and durability aspects.
- Design concrete mix according to given conditions as per IS Code

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA	CSE	Viva (V)	Term work (TW)	
2	0	2	3	50	30	20	25	25	150

Detailed Syllabus:

Sr. No	Topic name	Hours
1	Concrete Ingredients	3
	<p>Introduction: Historical background, Ingredient of concrete, Advantages of concrete over other materials, Current practice and future trends in concrete.</p> <p>Cement: Chemical composition, Heat of hydration and Structure of hydrated cement, Physical tests of cement.</p> <p>Aggregates: Categorization of aggregate and its Properties, Grading, Methods of combining aggregates, Specified grading, Testing of aggregates.</p> <p>Water: General requirements and impurities in water</p>	
2	Fresh Concrete & Hardened Concrete	6
	<p>Fresh Concrete Properties of fresh concrete, Workability tests as per IS standards, factors affecting workability, Segregation & Bleeding, Slump loss, Re-tempering. Mixing, Transporting, Placing, Compaction, and Finishing of concrete at site. Curing methods and their necessity.</p> <p>Hardened Concrete Various tests on Hardened concrete – Destructive: Compressive, Flexure, Tensile, and Bond tests. Introduction to Non-Destructive and semi-destructive testing using Rebound Hammer, Ultrasonic pulse velocity, and core cutting tests. Failure mechanism under compression & tension, Stress-strain behavior of concrete, Overview of Modulus of elasticity, Dimensional stability –Creep & Shrinkage.</p>	
3	Durability, Permeability & Mix Design of Concrete	6
	<p>Durability & Permeability Causes of deterioration in concrete and durability problems, Factors affecting durability, Transport mechanism of gases & fluids in concrete, Cracking & causes of cracking, Carbonation induced & corrosion-induced cracking. Alkali-aggregate reaction, Degradation by freeze & thaw, Sulphate attack, Durability under sea-water (marine environment).</p> <p>Mix Design Principles of concrete mix design, Parameters, and factors influencing mix design. Indian Standard methods of mix design, Acceptability criteria, variability of results, Various provisions of IS code for sound concrete.</p>	
4	Special Concrete and Concreting Methods	3
	Fiber-reinforced concrete, Polymer modified concrete, Self-compacting concrete, Lightweight concrete, High strength concrete, Ready Mix Concrete Hot & cold weather concreting, Precast Construction method.	
5	Steel & Aluminum	3
	Types of Steel, Manufacturing process Properties and advantages of aluminum and its products	

6	Wood and Wood Products	3
	Timber Classification, Structure of Timber, Properties of good timber. Seasoning process of timber, Diseases of timber, Defects in Timber, Timber Decay, Timber Testing and Preservation Plywood, Veneers, particle Boards, Wood and wood products – Applications	
7	Plastics & Wall Finishes	4
	Plastics Properties & Manufacturing process of Plastics Advantages of Reinforced polymers, applications as pipes, Doors, Furniture, walls etc. Wall Finishes Plaster – Types, Materials, Durability, Products and its applications Painting – Types, Materials, Durability.	

List of Practicals

Sr. No	Topic name	No. of Lab
A	Materials Test:	
1	Standard Consistency of Cement	2
2	Initial and Final Setting time of Cement	
3	Soundness test of cement	
4	Compressive Strength Test	1
5	Shape Test	1
6	Sieve Analysis	
7	Specific Gravity of Aggregate	1
8	Aggregate Impact Value	1
9	Aggregate Crushing Value	1
10	Aggregate Abrasion Value	1
B	Fresh Concrete Test:	
1	Slump Test	1
2	Compacting Factor Test	
C	Hardened Concrete Test:	
1	Concrete Mix Design	1
2	Compressive strength of concrete cube	1
3	Split Tensile Strength Test	
D	Non-Destructive Test:	
1	Rebound Hammer Test	1
2	Ultrasonic Pulse Velocity Test	
E	Tensile Test on Steel	1
F	Compression Test on Wood	

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G	Test on Brick	
1	Water Absorption of Brick	1
2	Dimension Test of Brick	
3	Compressive Strength of Brick	

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	25%	20%	15%	20%	00%

Instructional Method and Pedagogy:

At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

1. Prerequisite of the course and its pattern shall be discussed on the commencement of the course.
2. Lectures shall be conducted in class room using various teaching aids.
3. Presence in all academic sessions is mandatory which shall carry 5% marks of the total internal evaluation.
4. At the end of each unit/topic an assignment based on the course content shall be given to the students which shall carry 5% weightage for timely completion and submission of the assigned work.
5. The laboratory experiments are planned in such a way that it covers the practical aspects of the course contents. The performance of these experiments shall bring the clarity of the theoretical concepts which the students have studied during the academic sessions.

Recommended Study Material

Reference Books:

1. Concrete Technology; M.S. Shetty, S Chand Publication.
2. Concrete Technology; A.M. Neville, Pearson Publication.
3. Concrete Technology; M.L. Gambhir, Tata McGraw Hill Publication.
4. Concrete Technology; A. R. Santhakumar, Oxford University Press.
5. Building Materials; P. C. Varghese, Prentice Hall India
6. Engineering Materials; S. C. Rangwala, Charotar Publishing House
7. Building Materials; S. K. Duggal, New Age International Publishers
8. IS: 456-2000; Code of Practice – Plain and Reinforced Concrete
9. IS 10262-2019; Concrete Mix Proportioning — Guidelines