



**FIRST SEMESTER 2023-2024**

**Course Handout Part II**

Date: 11-08-2023

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

**Course No** : CE F230  
**Course Title** : Civil Engineering Materials  
**Instructor-in-charge** : Prof. P. N. Rao

**1. Course Description:**

This course provides the basic and enhanced overview on various construction materials presently used in practice. Physical, chemical and mineralogical characteristics of construction materials, standard testing methods, selection measures and quality control of construction materials are discussed in the course. Additionally, the course enlightens applications and relevant chemistry of construction materials including cement, aggregates, chemical and mineral admixtures, masonry materials, timber, bitumen, steel, glass, polymers, paints and other miscellaneous materials. Relevant Indian Standard codes of practice will be given emphasis throughout lecture and tutorial sessions.

**2. Course Level Objectives:**

1. On the completion of the course the learner will be able to prepare a choice of concrete ingredients for a given construction project to meet standard requirements and quality.
2. On completion of the course, the learner will be able to assess construction materials characteristics for flooring, roofing, partition, coatings and select the appropriate material for construction.
3. On completion of the course the learner will be able to conduct standard tests as per specifications and analyze the results.
4. On the completion of course the learner will be able to evaluate functional and durability problem associated with construction materials for a given site condition and application in a structures

**3. Prescribed Text Books:**

- T1.** Duggal, S.K. (2012) "Building Materials" New Age International Pvt. Ltd., New Delhi, 4<sup>th</sup> Edition.  
**T2.** Gambhir, M. L. (2013) Concrete Technology, McGraw-Hill Education (India) Pvt. Ltd, 5<sup>th</sup> Edition.

**Reference Books:**

- R1.** Bahurudeen A and Moorthy (2020). Testing of Construction Materials, ISBN 9780367644956, First International Edition (Boca Raton, London, New York). CRC Press, Taylor & Francis.  
**R2.** Newman, J. and B.S. Choo. Advanced Concrete Technology-Part 1-4. Constituent Materials. Butterworth-Heinemann. An imprint of Elsevier, United Kingdom, 2003.  
**R3.** William D. Callister, Materials science and engineering: An introduction/, 2007. John Wiley & Sons.  
**R4.** Relevant IS and ASTM standards.



#### 4. Course Plan

Lectures No	Topics to be covered	Learning Objectives	Chapter in the Text Book	SLO
1	Construction Materials- An overview	Discuss a few prominent construction materials. Describe important physical and mechanical properties of materials Draw and indicate important zones in typical stress-strain curves.	1, T1	(a)
2-5	Cement manufacturing process, composition and chemistry, types of cement, effect on properties	Illustrate important stages of cement production processes. Prepare a list of oxide components of cement and Bogue compounds with their proportions. Describe the mechanism of hydration of ordinary Portland cement	5, T1	(a), (d), (k)
6-7	Cement testing	Examine properties of cement in a laboratory as per standards.	5 T1	(b), (f)
8-13	Chemical and Mineral admixtures	Prepare a list of mineral admixture and chemical admixtures with their advantages, properties and mechanisms of actions. Evaluate an admixture for usage by considering cement admixture compatibility. Determine the optimum dosage of SP. List possible advantages and shortcomings. Analyze the effect of admixtures on fresh and hardened characteristics	9, T1 5, R1	(a), (c), (h), (J)
14-17	Aggregate classification and tests	Analyze important characteristics of aggregates and their influence in relation to performance of the mix. Define important phenomena related to aggregates such as of bulking, alkali aggregate reaction, segregation and bleeding. Experiment lab tests on aggregates to examine characteristics of aggregates as per standard specifications and test compressive and tensile strengths of concrete.	6, T1 3, R1	(b), (f)
18- 20	Concrete as a construction material and Mix design	Distinguish between Fresh and Hardened concrete. Examine factors affecting workability of fresh concrete	11, 13, T1	(b), (f), (c), (e)
21-22	Durability and Quality control of concrete	Durability of concrete. Quality Control of concrete. Non Destructive Testing	11, T1 13, R1	(b), (f)
23-24	Special Concretes	Describe salient feature of Lightweight aggregate concrete, Cellular concrete, No-fines concrete, High density concrete, FRC, HPC, SCC etc.,	12, T1 12, R1	(j), (d), (k), (i),
25-26	Stones: Properties,	Choose building stones as per their physical,	3, T1	(b)



	tests, selection	chemical and geological properties. Prepare a list of methods for preservation of stones.		
27-29	Clay products: Properties, tests, selection of Bricks	Prepare a list of important constituents and harmful ingredients in brick, and their impacts on properties of bricks. Compare important geometrical arrangements in brick masonry as per their characteristics and performance. Test bricks as per standards to analyze their relevant properties. Identify a good quality brick sample using simple techniques.	2, T1	<b>(b), (h)</b>
30	Lime: Properties, tests, application	Explain chemical composition and important types of lime. Discuss slaking and cementing action of lime.	8, T1	<b>(b)</b>
31-33	Wood and timber	Draw the microstructure and macrostructure of timber. Prepare a list of important processing methods of timber. Experiment engineering properties of timber using laboratory test methods along and across the grains as per the standards.	4, T1	<b>(a), (d), (b)</b>
34-36	Tar, bitumen, modified bitumen	Describe asphalt, tar and bitumen. Explore influence of the major ingredients of bitumen and its application. List modifiers used in bitumen and compare the superior quality of modified binders with bitumen Examine important physical and chemical properties of bitumen using laboratory experiments as specified in standards.	19, T1	<b>(a), (d), (b)</b>
37-38	Steel, ferrous and non-ferrous metals	List types of ferrous and non-ferrous metals Describe manufacturing of steel and its classification. Explain major types of reinforced steel. Illustrate corrosion mechanism for steel reinforcement and structural steel. Choose a particular type of steel as structural or reinforcement steel depending on its properties.	14, 15, T1	<b>(d), (k), (b)</b>
39	Paints and varnishes	Interpret characteristics of paints, varnishes and their influence on performance. Describe ideal characteristics of paints used for construction	18, T1	<b>(a), (d)</b>
40-42	Polymeric material, geo-synthetics and Misc. materials (FRP, Glass, ceramics)	Examine suitability of ceramics as building material by analyzing its properties, advantages and issues involved in usage. Transcribe application of FRPs. Describe manufacturing process of Fiber Reinforced Polymers and their response to external environment. List commonly used FRPs and their properties as well as advantages and disadvantages of using FRPs. Prepare list of glasses based on their applications and characteristics.	16, 21, 10, 20, T1	<b>(d), (k), (h), (j)</b>

43	Construction Equipment	Classify construction equipment based on applications	8-16 R4	(d), (k)
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#### \*Student Learning Outcomes (SLOs):

SLOs are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

- (a) an ability to apply knowledge of mathematics, science and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

#### Practical

S. No.	Name of the experiment
1	Soundness of Cement
2	Normal consistency of cement
3	Initial setting and final setting time of cement
4	Testing of bricks (IS 3495): Determination of compressive strength
5	Water absorption and efflorescence of Bricks
6	Tensile test and elongation of steel reinforcement
7	NDT: Rebound hammer test and Ultrasonic Pulse velocity test
8	Sieve analysis of Fine aggregate with zoning
9	Design the concrete mix for given strength as per IS code procedure and Determine the Slump, Compare compressive strength and split tensile strength of concrete
10	Workability by compaction factor test
11	Workability test: Vee-Bee Consistometer
12	Classes for sophisticated analytical techniques for construction materials

#### 5. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid Semester	90 minutes	25	09/10 - 9.30 - 11.00AM	Closed Book
Assignments	-	10	Continuous	Open Book



<b>Quizzes</b>	-	10	Continuous	Open Book
<b>Lab Records</b>	-	15	As per time-table	Open Book
<b>Comprehensive Exam</b>	180 min	40	06/12 FN	Closed Book

**6. Chamber Consultation Hour:** will be announced later in the class.

**7. Make-up Policy:** Makeup will be given only to the genuine cases with prior permission.

**8. Notice:** Notice concerning this course will be displayed on CMS and / or CE Department NB.

**9. Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor- In- Charge**

**CE F230**

