

25UCET412	CONCRETE TECHNOLOGY	Category	L	T	P	R	Credit	Year of Introduction
		PEC	3	0	0	0	3	2025

Preamble: This course helps students to understand the fundamentals of Concrete Technology . It covers the properties of cement, aggregates, admixtures, and different types of cement. The course explains testing of fresh and hardened concrete along with mix design principles. Students will be able to design concrete mixes and produce durable, workable, and quality concrete for construction projects.

Prerequisite: ICM104 Introduction to Civil Engineering

Course Outcomes: After the completion of the course, the student will be able to:

CO	Course Outcomes	Knowledge Level
CO1	Explain the composition, properties, and testing of cement, aggregates, and admixtures as per Indian Standards.	K2 Understand
CO2	Describe the behaviour of concrete at its fresh and hardened state	K2 Understand
CO3	Apply mix design principles, quality control concepts, and non-destructive testing methods for concrete.	K3 Apply
CO4	Explain the types and applications of special concrete and advanced concreting processes.	K2 Understand

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	2	-	-	-	-	1	2	1	1
CO2	3	2	-	-	-	2	-	-	-	-	1	2	1	2
CO3	3	3	3	-	-	2	-	-	-	-	2	3	3	2
CO4	3	2	-	-	-	3	-	-	-	-	2	2	2	3
Avg	3	2.25	3	-	-	2.25	-	-	-	-	1.5	2.25	1.75	2.0

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*		*	*	
CO2	*	*	*	*	*		*	*	
CO3	*	*	*	*	*		*	*	
CO4	*	*	*	*	*		*	*	

Wks Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*		*	*	

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	40	60	2.5 hrs

Continuous Internal Evaluation Pattern:

Attendance : 5 marks
Continuous Assessment Test : 20 marks
Continuous Assessment Assignment/IV : 15 marks

SYLLABUS

Module 1 (10 hrs)

Concrete Materials: Cement – manufacturing process – chemical composition – Bogue’s compounds – hydration – types of cement – properties of cement – tests on cement as per Indian Standard codes. Aggregates – role of aggregates in concrete – fine and coarse aggregates – shape and surface texture – strength and mechanical properties – moisture content and water absorption – bulking of sand – deleterious substances – grading and gradation curves – tests on aggregates as per Indian Standard codes. Admixtures – need and advantages – mineral admixtures such as fly ash, silica fume and blast furnace slag – chemical admixtures such as accelerators, retarders, plasticizers and superplasticizers – functions and dosage – testing and specifications as per Indian Standard codes.

Module 2 (12 hrs)

Fresh Concrete – workability – factors affecting workability – general tests on fresh concrete as per Indian Standard codes.
Hardened Concrete – compressive strength – tensile strength – flexural strength – modulus of elasticity – effect of water-cement ratio – general strength and durability tests as per Indian Standard codes.

Time-dependent properties – maturity concept – creep and its effects – shrinkage and its types.

Durability – factors affecting durability – permeability – cracking – corrosion of reinforcement – carbonation – chloride attack – sulphate attack – acid attack – fire resistance – frost damage – concrete in sea water – alkali silica reaction – durability-related tests as per Indian Standard codes.

Module 3 (11 hrs)

Mix proportioning- Mix design ,nominal mix, design mix , concept of mix design, variables of proportioning - general considerations.

Various methods of mix design - design of concrete mix as per IS 10262- 2019

Statistical quality control of concrete, mean strength, standard deviation, coefficient of variation, sampling and testing, acceptance criteria.

Non-destructive testing of concrete- surface hardness test- ultrasonic pulse velocity method, pull-out test-core test.

Module 4 (9 hrs)

Special concrete - Conventional and Advanced types.

Special processes and technology - 3D concrete printing, underwater concrete, mass concrete; slip form construction, Sprayed Concrete, prefabrication technology- Robotic shotcreting and automated batching plants-Laser scanning / BIM-integrated quality control for concrete work- Vacuum dewatered concrete- Thermal energy storage concrete- Smart concrete with embedded sensors- Carbon capture concrete / CO₂ curing technology-IoT-based concrete monitoring.

Industrial Visit (Recommended Activity)

Visit a ready-mix concrete plant and prepare a detailed report / Design a concrete mix and cast concrete cubes.

Text Books:

1. Shetty, M. S. (2018). *Concrete technology*. S. Chand & Co.
2. Santhakumar, R. (2018). *Concrete technology*. Oxford University Press.
3. Neville, A. M. (2012). *Properties of concrete* (5th ed.). Pearson Education India.

Reference Books:

1. Bureau of Indian Standards. (2019). *IS 10262:2019: Concrete mix proportioning—Guidelines*. BIS.
2. Gambhir, M. L. (2017). *Concrete technology* (5th ed.). Tata McGraw-Hill Publishers.
3. Mehta, P. K., & Monteiro, P. J. M. (2017). *Concrete: Microstructure, properties, and materials* (4th ed.). Tata McGraw-Hill Publishers.

END SEMESTER EXAMINATION – MODEL QUESTION PAPER

Course Code	25UCET412
Course Name	CONCRETE TECHNOLOGY
Max. Marks: 60	Duration: 2.5 Hours

Use of IS: 10262 (2019) is permitted.

Part A

(Answer all questions. Each question carries 3 marks)

Qn No.	Question	Marks	CO	BL
1	Outline the advantages of using well graded aggregates in concrete construction.	3	1	L2
2	Summarize the role of superplasticizers in enhancing concrete performance.	3	1	L2
3	Explain the concept of workability of concrete and discuss the factors affecting it	3	2	L2
4	Summarize three advantages of NDT testing over conventional testing.	3	2	L2
5	Outline the target mean strength in concrete mix design.	3	3	L2
6	Summarize the advantages of roller compacted concrete.	3	4	L2
7	Explain the effect of sea water on durability of concrete.	3	4	L2
8	Explain carbonation in concrete and its effect on the corrosion of embedded steel reinforcement.	3	4	L2

Part B

(Answer any one full question from each Module. Each carry 9 marks)

Module I

Qn No.	Question	Marks	CO	BL
9.a	Explain i) grading of aggregates ii) artificial aggregates.	3	1	L2
9.b	Differentiate mineral and chemical admixtures. Explain any two admixtures from each type.	6	1	L2

OR

10.a	Describe hydration of cement. Compare products of hydration in terms of rate of hydration.	3	1	L2
10.b	Explain the tests conducted on cement according to Indian Standards to determine (a) Initial setting time and (b) Final setting time.	6	1	L2

Module II

Qn No.	Question	Marks	CO	BL
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11.a	Explain the effect of w/c ratio on fresh and hardened concrete properties.	3	2	L2
11.b	Differentiate (i) slump test (ii) compaction factor test and (iii) Vee Bee consistometer test in terms of its suitability of applications	6	2	L2
OR				
12.a	Explain the factors influencing the test results of the rebound hammer test.	3	2	L2
12.b	Describe the procedure of an NDT method suitable to assess the penetration (S) resistance of concrete.	6	2	L2
Module III				
Qn No.	Question	Marks	CO	BL
13	A concrete structure shows signs of deterioration. Select an appropriate non-destructive testing method and justify your selection.	9	3	L3
OR				
14	Apply the provisions of IS 10262:2019 to design a concrete mix for M25 grade concrete using the following data: • Cement: OPC 43 grade • Exposure condition: Moderate • Required workability: 75 mm slump • Maximum size of aggregate: 20 mm (rounded aggregate) • Fine aggregate: Zone III • Specific gravity of cement: 3.15 • Specific gravity of coarse aggregate: 2.63 • Specific gravity of fine aggregate: 2.65 • Aggregates are in SSD condition <i>Assume suitable values for any other missing data as per IS 10262:2019 guidelines.</i>	9	3	L3
Module IV				
Qn No.	Question	Marks	CO	BL
15. a	Summarize the fire resistance of concrete.	3	4	L2
15. b	Describe form construction and list out any two applications of it.	6	4	L2
OR				
16. a	Explain any four methods for controlling sulphate attack in concrete.	3	4	L2
16. b	Describe the following special concretes in detail. (i) mass concrete and (ii) sprayed concrete.	6	4	L2

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