



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Civil and Infrastructure Engineering
Subject Code: 3144004

Semester – IV
Subject Name: Concrete Technology

Type of course: Professional Core Course

Prerequisite: Material Science

Rationale: Concrete is the most widely used as a construction material in the world. It plays an important role in Infrastructure and building construction. This subject is intended for gaining useful knowledge with respect to facts, concepts and procedures related to manufacturing of concrete with consideration of strength and severability criteria, because it is heterogeneous material and has complex microstructure. Understanding the basic behaviour of concrete is very important for civil engineering students to become efficient civil engineering professionals. It will help the students to explore the material, its properties, intrinsic nature and application & also the recent advances in field of concrete technology.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Introduction of concrete, Historic development, Composition of concrete, Advantages of concrete over other materials, Advances and future trends in concrete, Overview of Sustainability and Concrete development.	2
2	Concrete Making Materials: Cement: Manufacturing process of cement, Chemical composition, Hydration reaction of cement, Tests on cement, Types and properties of pozzolonic materials used for partial cement replacement in concrete. Types of special cement. Aggregates: Classification, IS specifications, Properties, Grading, Methods of combining aggregates, specified grading, Testing of aggregates. Water – General requirements & limiting values of impurities and water reducing chemical admixtures.	6
3	Microstructure of Hydrated Cement Paste: Hydration of portland cement, Heat of hydration, Microstructure of Hydrated Cement, Transition Zone, Effect of Cement Characteristics on Strength and Heat of Hydration, Water Requirements for Hydration, Alkali Aggregate Reaction	6



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4	Fresh Concrete: Properties of fresh concrete, Definition and Measurement methods of workability as per IS and ASTM standards, factors affecting workability, Segregation & Bleeding, Slump loss, Re-tempering, Site preparations for concreting, mixing, conveying, placing, compaction, finishing of concrete, methods of curing.	6
5	Hardened Concrete: Strengths of hardened concrete (Tensile & Compressive strength, Flexural & Bond strength), standard test methods as per IS and ASTM, Failure mechanism under compression & tension, Stress-strain behaviour of concrete, Overview of Modulus of elasticity, Dimensional stability – Creep & Shrinkage	6
6	Durability & Permeability of concrete: 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-Silica Reaction, Degradation by freeze & thaw, Sulphate attack, Durability under sea-water (marine environment).	5
7	Mix design of Concrete: 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.	5
8	Special concrete and Concreting methods: Advanced cement based composites, Fibre reinforced concrete, Polymer modified concrete, Self-compacting concrete, Light weight concrete, High strength concrete, Lightweight & heavy weight concrete, High volume fly ash concrete. Special concreting methods: Pumped concrete, Ready mix concrete, Under-water concreting, Hot & cold weather concreting, Precast concrete.	4
9	Miscellaneous Topics: Destructive, semi-destructive & Non-destructive testing types and its methodology. Problems faced during test evaluation, Various Test methods and procedure like Core cutting test, Rebound Hammer test, Ultra-sonic pulse velocity, Penetration tests, Pull out tests etc.	4

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
35	35	20	05	05

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.



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Texts/ Reference Books:

- Gupta.B.L., Amit Gupta, “Concrete Technology”, Jain Book Agency, 2010.
- Shetty,M.S, “Concrete Technology”, S.Chand and Company Ltd, New Delhi, 2003
- Santhakumar,A.R; “Concrete Technology” , Oxford University Press, New Delhi, 2007
- Neville, A.M; “Properties of Concrete”, Pitman Publishing Limited, London,1995
- P. Kumar Mehta, Paulo J.M. Monteiro “Concrete: Microstructure, Properties, and Materials”, 4th Edition, Tata McGraw Hill Publishing Co Ltd.
- Gambir, M.L; “Concrete Technology”, 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi.
- Properties of Concrete by A. M. Neville, Pearson Education Limited.
- IS 10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998

Course Outcomes: After successful completion of the course the students shall be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Components of cement and advantages of concrete over other materials. Explain types, properties and testing procedure of concrete making materials.	25 %
CO-2	Elucidate facts, concepts, and properties of hydrated cement microstructure, which influence over all quality of concrete. Describe properties of fresh concrete and factors affecting workability of concrete during its early stage and testing of fresh concrete as per codal provision.	30 %
CO-3	Illuminate strengths of hardened concrete and failure mechanism under loading conditions. Explicate creep and shrinkage of concrete. Elucidate durability and permeability of concrete, as hardened concrete is having complex structure, which affect overall performance of the concrete over a period of design life.	25 %
CO-4	Prepare and develop concrete mix design based on material characteristics and design mix principles of manufacturing of concrete as per IS code. Describe special concrete and concreting methods and miscellaneous topics on advanced concrete technology.	20 %



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List of Experiments and term works:

- Testing of Cement
- Testing of Aggregates
- Testing of Water
- Testing of Admixture dose.
- Technical assignments:
 - [1]. One site visits and technical report on the visit of any on-going Construction Site (visit report should contain: details of the project, stage of construction, standard practice of concrete making, placing, transporting and compaction. Detailing of Concrete Mix Design adopted, Ready Mix Concrete (RMC) plant functional and operation requirement or any modern advanced concrete technology adopted on site.)
 - [2]. Visit to a construction material related exhibition.