Program : **Diploma in Civil Engineering**	
Course Code : **3012**	Course Title: **Concrete Technology**
Semester : **3**	Credits: **3**
Course Category: **Program Core**	
Periods per week: **3 (L:2, T:1, P:0)**	Periods per semester: **45**

Course Objectives:

- To impart knowledge of concrete of desired compressive strength and specification
- Enable students to maintain the quality of concrete under different conditions.
- To impart knowledge to alter the properties of concrete according to different conditions and characteristics of admixtures.

Course Prerequisites:

Topic	Course code	Course name	Semester
Basic knowledge about construction materials		Building construction and construction materials	3

Course Outcomes:

On completion of the course, the student will be able to:

COn	Description	Duration (Hours)	Cognitive Level
CO1	Identify the properties of ingredients of concrete	10	Understanding
CO2	Interpret the properties of fresh and hardened concrete	11	Understanding
CO3	Perform concrete mix design	11	Applying
CO4	Identify special types of concrete	11	Understanding
	Series test	2	

CO – PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2						
CO2		2				3	
CO3	3		3				
CO4		3					

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline:

On completion of the course, the student will be able to:

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Identify the properties of ingredients of concrete**		
M1.01	List different types of cement and its field applications	2	Remembering
M1.02	Identify properties and related tests on cement	3	Understanding
M1.03	Outline the properties and related tests of fine and coarse aggregate	3	Understanding
M1.04	Suggest the quality of water for concrete works	2	Understanding

Contents:

Module I – Properties of Ingredients of Concrete

Ingredients of cement, Manufacturing of cement- dry process, wet process, Hydration of cement, Types of cement, Physical properties of OPC & blended cement - fineness, standard consistency, setting time, soundness, compressive strength-Different grades of OPC and relevant BIS codes - Testing of cement: Laboratory tests-fineness, standard consistency, setting time, soundness, compressive strength - Storage of cement and effect of storage on properties of cement - BIS Specifications and field applications of different types of cements: Rapid hardening, Low heat, Portland pozzolana, Sulphate resisting, Blast furnace slag, High Alumina and White cement - Aggregates: Requirements of good aggregate-Classification according to size and shape-Fine aggregates: Properties, size, specific gravity, bulk density, water absorption and bulking, fineness modulus and grading zone of sand - silt content and their specification as per IS 383 - Concept of crushed Sand - Coarse aggregates: Properties, size, shape, surface texture, water absorption, soundness, specific gravity and bulk density, fineness modulus of coarse aggregate- grading of coarse aggregates - crushing value, impact value and abrasion value of coarse aggregates with specifications - Water: Quality of water, impurities in water and permissible limits for solids.

CO2	**Interpret the properties of fresh and hardened concrete**		
M2.01	Identify different grades of concrete	3	Understanding
M2.02	Outline properties of fresh and hardened concrete	3	Understanding
M2.03	Explain various methods of Batching, Mixing, Transportation, Placing, Compaction, Curing and surface finishing of concrete.	3	Understanding
M2.04	Interpret joints in concrete	2	Understanding
	Series Test – I	1	

Contents:

Module II - Properties of Fresh and Hardened Concrete

Concrete: Different grades of concrete, nominal and design mix, provisions of IS 456 - Duff Abrams' water cement (w/c) ratio law -significance of w/c ratio - range of w/c ratio for different grades - maximum w/c ratio for different grades of concrete for different exposure conditions as per IS 456-Properties of fresh concrete: Workability - Factors affecting workability of concrete. Determination of workability of concrete by slump cone, compaction factor, Vee-Bee Consistometer- workability requirement for different types of concrete works - Segregation- bleeding and preventive measures - Properties of Hardened concrete: Strength, Durability, Impermeability - Concreting Operations: Batching, Mixing, Transportation, Placing, Compaction, Curing and finishing of concrete - Joints in concrete construction - Types of joints - methods for joining old and new concrete - materials used for filling joints.

CO3	**Perform concrete mix design**		
M3.01	Identify variable parameters in mix design	3	Understanding
M3.02	Perform concrete mix design	3	Applying
M3.03	Explain testing procedure of hardened concrete	3	Understanding
M3.04	Distinguish various methods of water proofing	2	Understanding

Contents:

Module III - Concrete Mix Design and Testing of Concrete

Concrete mix design: Objectives - methods of mix design - study of mix design as per IS 10262 (only procedural steps) - Testing of concrete - determination of compressive strength of concrete cubes at different ages - interpretation and co-relation of test results - Non-destructive testing of concrete: Importance of NDT tests -Rebound hammer test - working principle of rebound hammer - factors affecting the rebound index- Ultrasonic pulse velocity test as per IS 13311 (part 1 and 2) - waterproofing: Importance and need of waterproofing - methods of water proofing - materials used for water proofing.

CO4	**Identify special types of concrete**		
M4.01	Outline additives and admixtures suitable for various purposes and explain their properties.	3	Understanding
M4.02	Distinguish different types of special concrete used for specific applications	4	Understanding
M4.03	Identify the effect of cold weather on concrete	2	Understanding
M4.04	Identify the effect of hot weather on concrete	2	Understanding
	Series Test – II	1	

Contents:

Module IV - Chemical Admixture, Special Concrete and Extreme Weather concreting

Admixtures in concrete - Purpose, properties and application for different types of admixture - accelerating admixtures - retarding admixtures - water reducing admixtures - air entraining admixtures and super plasticizers- Special Concrete - Properties, advantages and limitation of different types of Special concrete - Ready mix Concrete - Fiber Reinforced Concrete - High performance Concrete - Self-compacting concrete - lightweight concrete, Geopolymer concrete- Mass concrete - Cold weather concreting - effect of cold weather on concrete - precautions to be taken while concreting in cold weather condition - Hot weather concreting - effect of hot weather on concrete - precautions to be taken while concreting in hot weather condition. Underwater concreting- Concrete exposed to sea water.

Text / Reference:

T/R	Book Title/Author
T1	Concrete Technology, Gambhir, M.L, Tata McGraw Hill Publishing Co. Ltd., Delhi
R1	Concrete Technology, Shetty, M.S, S. Chand and Co. Pvt. Ltd., Ram Nagar, Delhi
R2	Concrete Technology, Santhakumar, A. R., Oxford University Press, New Delhi
R3	Concrete Technology, Neville, A. M , Pearson Education Pvt. Ltd., New Delhi.
R4	Laboratory Manual in Concrete Technology, Sood, H., Kulkarni P. D., Mittal L. N., CBS Publishers, New Delhi.

Online Resources:

Sl.No	Website Link
1	https://civiltoday.com/civil-engineering-materials/cement/111-properties-of-cement-physical-chemical-properties
2	https://theconstructor.org/concrete/workability-of-concrete-types-strength/11739/
3	https://theconstructor.org/concrete/types-concrete-admixtures/5558/