GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Civil Engineering

Subject Code : DI04006011

Subject Name : Concrete Technology

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	PCC

Prerequisite:	Professional Core Courses
Rationale:	Concrete is the most widely used man-made construction material in the world and is second only to water as the most utilized substance on the planet. It is the material of choice where strength, impermeability, durability, performance, fire resistance and abrasion resistance are required. It plays an important role in nation building through infrastructure and private building construction. The knowledge of concrete and its properties in the plastic condition and in hardened condition are highly important in order to make Civil Engineering structure safe and serviceable. This course focuses on students' acquisition of knowledge, skills & practices in concrete works and also focuses on the recent advances in the field of concrete technology with emphasis on quality control of concrete.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Select suitable concrete materials for different site conditions and required concrete works.	R,U,A
02	Prepare concrete of required specifications under different conditions.	R,U,A
03	Check the quality of concrete.	R,U,A
04	Design concrete mix proportions for required specification.	R,U,A
05	Prepare special concrete using relevant admixture and concreting materials.	R,U,A
06	Apply appropriate repairs and retrofitting techniques for concrete structures.	R,U,A

**Revised Bloom's Taxonomy (RBT)*

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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE(E)	PA (M)	PA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Cement, Aggregates and Water** 1.1 History of cement invention. 1.2 Overview of Cement Manufacturing. 1.3 Bogue's compounds and its functions 1.4 Physical and Chemical properties of cement. 1.5 Testing of cement as per BIS. 1.6 Various Grades and types of cements for different site conditions and its properties. 1.7 Role of Aggregate, types of aggregate and it's source, Classification of aggregate, Soundness of aggregate, Alkali Aggregate Reaction, Grading of aggregate. 1.8 Testing of aggregate as per BIS. 1.9 Quality of water, impurities in mixing water and permissible limits as per BIS.	07	15
2.	**Fresh Concrete** 2.1. Concrete chain - Various stages of making fresh concrete at site 2.2. workability, factors affecting workability, Effect of water cement ratio, adjustments of materials to avoid segregation and bleeding , methods of Measurement of workability as per BIS - slump test, compaction factor test, flow table test, vee bee test . 2.3. Methods of Batching, mixing of materials for making fresh concrete - hand mixing and machine mixing, mixing time. 2.4. Methods of Transportation of fresh concrete - conventional and through pumps and pipeline. 2.5. Placing of concrete - formwork stripping time, under water concreting 2.6. Compaction, importance of compaction, methods - hand compaction, machine compaction - various vibrators and other equipments, time of vibration, vibrating techniques and precautions.	08	20

	2.7. Methods of finishing of fresh concrete, Laitance & its removal. 2.8. Curing, importance of curing, period of curing accelerated curing, Conventional methods of curing - water curing methods, Special methods of curing- steam, membrane, Infrared, Electrical.		
3.	**Hardened Concrete** 3.1 Hardened Concrete and its Properties: Compressive Strength, Tensile Strength, Bond Strength, Flexural Strength, Durability and impermeability. 3.2 Factors affecting Compressive Strength. 3.3 IS Test Procedure to find Compressive & Tensile Strength of Concrete, Acceptance Criteria, and Mean Strength & Standard Deviation. 3.4 Creep and Shrinkage of Concrete & its effect, factors affecting Creep and shrinkage. 3.5 Durability of Concrete & factors affecting it. 3.6 Importance of NDT. 3.7 Methods of NDT for Concrete- Rebound Hammer Test, Ultrasonic Pulse Velocity Test.	08	20
4.	**Concrete Mix Design** 4.1 Nominal Mix and Design Mix. 4.2 Concrete Mix Design and its importance. 4.3 Different methods of Mix Design and its suitability. 4.4 Concrete Mix Design as per IS 10262. 4.5 Example of Mix design as per IS method for ordinary and standard grade of concrete without and with admixtures.	08	15
5.	**Chemical Admixture, Special Concrete and Modern Trends** 5.1 Admixtures in concrete: Purpose, properties and application for different types of admixture such as accelerators, retarders, water reducing admixtures, air entraining agents and super plasticizers. 5.2 Special Concrete: Properties, Advantages and limitations of the following types of Special Concretes Self-Compacting Concrete (SCC), Pervious Concrete, Fiber reinforced concrete, Ready mix concrete, Fly ash concrete, Recycled Aggregate Concrete, High performance Concrete, 3D printed Concrete 5.3 Modern trends and research in concrete technology, relevant journals and institutes.	07	15
6.	**Repairs, Rehabilitation and Retrofitting of Concrete Structure** 6.1 Definition of repair, rehabilitation and retrofitting 6.2 Deterioration of concrete, types, causes and prevention. 6.3 Corrosion of reinforcement, causes and prevention. 6.4 Repair and Rehabilitation stages- Removal of damaged concrete, Pretreatment of surfaces and reinforcement, Application of repair	07	15

	materials, Repair Procedure. 6.5 Repair and Rehabilitation material - Cement, Steel and special material like, Shotcrete, Epoxy resins, Epoxy mortar, Gypsum cement mortar, Quick setting cement mortar etc. 6.6 Repair and Rehabilitation techniques - Grouting, Guniting, Routing and sealing, Stitching, Drilling and Plugging etc. 6.7 Retrofitting Methods - Adding Steel Bracing, Jacketing Method, External Plate Bonding, Base Isolation Technique, Mass Reduction Technique, Wall Thickening Technique, Fiber Reinforced Polymer (FRP), Adding Shear Wall, Epoxy Injection Method, Section Enlarging Reinforcing Method etc.		
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**30**	**50**	**-**	**-**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Eval6uate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Concrete Technology Theory and Practice	M S Shetty	S Chand & Company Ltd, New Delhi ISBN-13:978-9352533800
2	Concrete Technology	Shanthakumar A R	Oxford University Press, New Delhi ISBN-13: 978-0199458523
3	Concrete Technology Theory and Practice	M L Gambhir	McGraw Hill Education (I) Pvt Ltd, New Delhi ISBN-13: 978-1259062551
4	Concrete: Microstructure, Properties, and Materials	P Kumar Mehta Paulo J M Monterio	McGraw Hill Education (I) Pvt Ltd, New Delhi ISBN-13: 978-9339204761
5	Properties of concrete	A M Nevill	Pearson Education

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
		J J Brooks	ISBN-13: 978-9353436551
6	IS 10262		Bureau of Indian Standards

(b) Open source software and website:

1) NPTEL Course :-Concrete Technology by IIT, Delhi
   https://nptel.ac.in/courses/105102012
2) Concrete Technology laboratory Tests :
   https://www.youtube.com/playlist?list=PLkyVnO47pDX9YJglk1o2iYzWgABo5I_xA
3) Virtual Lab by Ministry of Education, Government of India:
   www.vlab.co.in

Suggested Course Practical List:

Sr. No.	Practical	Unit No.	Approx. Hrs. required
1	Determine Fineness (with sieve) and Soundness of cement.	I	02
2	Determine compressive strength of cement.	I	02
3	Determine Flakiness and Elongation index of coarse aggregate	I	02
4	Determine Impact, Crushing and Abrasion value of coarse aggregate	I	04
5	Determine specific gravity of fine and coarse aggregate	I	02
6	Determine grading zone of fine aggregate	I	02
7	Determine suitable proportion of all-in-aggregate as per grading limits	I	02
8	Measure workability of concrete by slump test and compaction factor test.	II	02
9	Determine compressive strength of concrete specimen.	III	02
10	Determine tensile strength of Concrete specimen (cylinder and beam specimen)	III	04
11	Non Destructive Test on concrete - Rebound Hammer	III	02
12	Design concrete mix proportions as per IS: 10262, guidelines	III	04
	Total hours		**30 Hrs.**

List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications	Practical No.
1	Le- Chatelier test apparatus and other relevant assembly	01
2	Assembly of compressive strength of cement determination along with a cement cube vibrating machine.	02
3	Thickness gauge with other relevant assembly	03
4	Elongation gauge with other relevant assembly	03
5	Aggregate impact testing machine	04
6	Aggregate crushing test apparatus	04
7	Los Angeles aggregate abrasion testing machine	04
8	Density bottles/ Pycnometer for specific gravity determination.	05
9	Slump cone test apparatus	08
10	Compaction factor test apparatus	08
11	Compression testing machine	2,4,9 and 10
12	Rebound hammer	11
13	Tools and Containers for mixing of concrete mixture	8 to 10 and 12
14	Concrete mixture and other required equipments for mixing	8 to 10 and 12
15	Vibrating table for concrete moulds	9,10 and 12
16	Electronic weighing balance, Different size concrete moulds, Gauging Trowel, Shovel, Sieve set, Small and big Containers etc	1 to 12

Suggested Project List:

a) Compare at least two physical properties of cement of two different companies with different prices.
b) Compare at least two properties of fine aggregate from two different sources with different prices.
c) Compare at least two properties of coarse aggregate from two different sources with different prices.
d) Measure the effect of water cement ratio on workability of concrete by slump test.
e) Measure the effect of water cement ratio on workability of concrete by compaction factor test.
f) Measure the effect of water cement ratio on compressive strength of concrete.
g) Measure the effect of curing on the compressive strength of concrete.

h) Measure the effect of admixture on workability and strength of concrete.
i) Prepare special concrete with non conventional material.
j) Measure the quality of concrete at two different places with non-destructive tests.
k) Prepare a computer program or spread sheet for Concrete Mix Design as per IS:10262 .

Suggested Activities for Students: If any

a) Conduct a market survey for cement for various companies, cement grade and price.
b) Conduct a market survey for fine aggregate for various types and prices.
c) Conduct a market survey for coarse aggregate for various types and prices.
d) Conduct a market survey for various types of admixtures and price
e) Visit and collect photographs of Batching, mixing, transporting, placing and finishing of fresh concrete from two different construction sites.
f) Visit and collect information and photographs of workability tests carried out on fresh concrete on construction sites.
g) Visit and collect information regarding quality control measures for concrete taken by site engineers on any construction site.
h) Visit the nearby RMC plant.
i) Prepare presentation on at least one research paper related to latest trends of concrete technology from any journal of civil engineering.

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