GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL ENGINEERING (06)

CONCRETE TECHNOLOGY

SUBJECT CODE: 2140608

B.E. 4th Semester

Type of course: Compulsory

Prerequisite: Material Science

Rationale: Concrete is the most widely used construction material in the world made by mixing Portland cement with sand, crushed rocks and water. It plays an important role in Infrastructure and Private building construction. It is heterogeneous and has complex microstructure. Understanding the basic behaviour of concrete is very important for civil engineering students to become efficient civil engineering professionals. The course on Concrete technology acquaints the students with this second largest material in use after water. 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	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	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.	02	10
2	Concrete Making Materials: 2.1 Cement: Chemical composition, Hydration of cement, structure of hydrated cement, Tests on cement (special cements, water chemical admixtures. 2.2 Aggregates: Classification, IS specifications, Properties, Grading, Methods of combining aggregates, specified gradings, Testing of aggregates. 2.3 Water – General requirements & limiting values of impurtities	08	15
3	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. Curing & various	05	15

	methods of curing.		
4	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	05	15
5	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-aggregate reaction, Degradation by freeze & thaw, Sulphate attack, Durability under sea-water (marine environment).	07	15
6	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.	05	10
7	Special concrete and Concreting methods: advanced cement based composites, Fibre reinforced concrete, Polymer modified concrete, Self-compacting concrete, Light weight concrete, High strength concrete, Light-weight & 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.	04	10
8	Miscellaneous Topics: Non-Destructive testing of concrete – Introduction to Destructive, semi-destructive & Non-destructive testing methodology, Problems faced during Non-destructive evaluation, Test methods like Rebound Hammer test, Ultra-sonic pulse velocity, Penetration tests, Pull out tests. Overview of Fracture Mechanics – Origin of fracture mechanics, Understanding the quassi-brittle nature of concrete, Failure of concrete under low stress, Micro—cracking, crack propagation, stress concentration at openings.	03	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
35	35	20	5	5

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

Reference Books:

1. Properties of Concrete - Neville A. M.
2. Concrete Microstructure, Properties and Materials –P.Kumar Mehta / Paulo J.M.Monteiro
3. Concrete Technology- Shetty M. S.
4. Advanced Concrete Technology – ZONGJIN Li
5. Concrete Technology- Gambhir M. L.
6. Concrete Technology by A.R. Santhakumar, IIT Madras

Course Outcome:

After learning the course the students should be able to understand the basic behaviour of concrete, its application in varied environment, help them to handle the material on site and thus become good professional engineers.

List of Experiments/Tutorials:

(a) Tests on cement, aggregates, Design & making of concrete, Tests on fresh concrete, Hard concrete (destructive & non-destructive test methods),

Open Ended Problems:

1. Prepare Chart listing all the Indian Standard Codes relevant to testing of Sand, aggregate, cement, bricks, mix design, special concrete, concrete testing, reinforced cement concrete, non-destructive testing etc.

2. Prepare chart showing step-wise procedure for tests on Cement, Aggregate, mortar, Testing of fresh & hardened concrete, Non-destructive testing of concrete.

3. Prepare 3 specimens each of Plain concrete & Reinforced cement concrete of M20 grade. Test it under flexure and compare the failure, Plot the stress vs strain graph for the same. Subject the beam specimens to aggressive deterioration (like alternate wetting & drying, salt exposure), test the beams for carbonation and strength loss (if any).

Major Equipments: Compression testing machine, Concrete mixer

List of Open Source Software/learning website:

http://nptel.ac.in
http://ocw.mit.edu/courses/civil-and-environmental-engineering

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.