GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Subject Code: BE03006021
Subject Name: Concrete Technology

w. e. f. Academic Year:	2024-25
Semester:	3
Category of the Course:	Professional Core Course

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 building construction. It is heterogeneous in nature and has complex microstructure. Basic understanding of this subject is very important for civil engineering students to work on the construction site. It will help the students to explore the material, its properties, intrinsic nature and application & also the recent advances in field of concrete technology.

Course Outcomes:

Sr. No.	CO statement	RBT level
CO-1	Comprehend the important ingredients of concrete and its role in influencing thebehavior of concrete under different environment conditions	BL2
CO-2	Discuss the results of the various experiments related to different ingredients of concrete, fresh concrete & hardened concrete.	BL2
CO-3	Apply the concepts of Mix design to produce the concrete of adequate strength anddurability	BL3
CO-4	Differentiate the correct type of concrete and concreting technology required for particular exposure and site condition	BL4
CO-5	Judge the underlying principle and interpretation of different types of the non-destructive & semi destructive testing methods	BL5

Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	TW/ SL	TH		ESE (E)	PA (M)	PA/ (I)	TW/ SL (I)	ESE (V)	
45	0	30	45	120	04	70	30	20	30	50	200

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1.	**General**: Early history of modern cement, Composition of concrete, Advantages of concrete over other materials, Advances and future trends in concrete, Overview of Sustainability and Concrete development.	2	10
2.	**Ingredients of Concrete**: Cement: Manufacturing of modern cement, Chemical composition, Hydration of cement, structure of hydrated cement, Various types of cement, Tests on cement. Aggregates: Classification of aggregates, IS specifications, Physical and Mechanical properties of aggregates, Effect of size, shape and grading on concrete, Sampling & Testing of aggregates Water – General requirements & limiting values of impurities. **Admixtures:** Additives & Admixtures, Functions of admixtures, Classification of admixtures, Applications. **Mineral admixtures** – Fly ash, silica fume, GGBS and other pozzolanic materials, Damp proofing and water proofing admixture, **Chemical Admixtures:** Accelerators, Retarders, Water reducing admixtures, Plasticizers, Super plasticizers, Dosage and application.	10	20
3.	**Fresh Concrete**: Definition and Properties of fresh concrete, Measurement of workability as per IS and ASTM standards, Factors affecting workability, Requirement of workability, Segregation & Bleeding, Slump loss, Re-tempering, Site preparations for concreting, Mixing, Conveying, Placing, Compaction, Finishing of concrete. Curing & various methods of curing.	5	20
4.	**Hardened Concrete**: Strengths of hardened concrete (Compressive &Tensile strength, Flexural & Bond strength), standard test methods as per IS and ASTM, Stress-strain behaviourof concrete, Overview of Modulus of elasticity, Failure mechanism under compression & tension, , Dimensional stability – Creep & Shrinkage.	5	20

5	**Durability & Permeability of concrete**: Causes of deterioration in concrete and durability problems, Factors affecting durability, Cracking & causes of cracking, Carbonation induced & corrosion induced cracking, Alkali-aggregate reaction, Degradation by freeze & thaw, Sulphate attack, Durability under sea-water (marine environment), Problems in mass concrete and controlling practices.	5	10
6.	**Mix design of Concrete**: Concept, Objectives & Principles of concrete mix design, Parameters and factors influencingmix design, Indian Standard methods of mix design, Acceptability criteria, variability of results, Various provisions of IS code for sound concrete.	5	10
7.	**Special concrete and Concreting methods**: High strength concrete, High performance concrete, Fiber reinforced concrete, Bacterial concrete, Polymer modified concrete, Geopolymer concrete Self-compacting concrete, Light weight concrete, High density concrete, High volume fly ash concrete. **Special concreting methods**: Pumped concrete, Ready mix concrete, Under-water concreting, Hot & cold weather concreting, Pre-castconcrete, pre-placed concrete.	6	5
8.	**Non-Destructive Testing of in–Situ 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, Carbonation and Pull-out tests.	7	5
	TOTAL	**45**	**100**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
40	**40**	**5**	**5**	**5**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E:

Evaluate C:Create and above Levels (Revised Bloom's Taxonomy)

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

Term Work:

1. Term work shall consist of tests on cement and aggregate, fresh concrete and hardened concrete.
2. Term work shall include Presentation on the topics assigned by lab faculty member.
3. Term work shall include field visit and students will have to submit a report on it.
4. Oral/Practical marks include viva-voce on practical performed and submitted reports.

Reference Books:

1. A.M. Neville; Properties of Concrete
2. P Kumar Mehta, Monteiro; Concrete Technology
3. A R Santhakumar; Concrete Technology
4. M S Shetty; Concrete Technology
5. M L Gambhir; Concrete Technology
6. IS: 456-2000, Plain and Reinforced Concrete -code for practice
7. IS:10262-2019 Concrete Mix Proportioning – Guidelines

- **Activities suggested under self-learning**

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Industry visit –Construction Industry, cement industry, ceramic industry, tile industry and steel industry etc. related to Civil Engg.	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
2.	Technical Video based learning related to topics of the course & new/emerging technology.	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
3.	Assignment writing. Numerical based assignment related to topics of the course	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.
4.	Problem solving/Coding using any programming language or application of software related to civil engineering	5 small coding-based assignment of 2h each. Total = 10h	Based on the coding solution submitted.
5.	Self learning on-line courses	Minimum duration of	Examination based assessment

	related to structural analysis, concrete technology , Building construction and BIM	the course should be 10h.	at the end of course. Based on the certificate produced.
6.	Complex problem solving related to building construction, leakage problem and concreting in water etc	Maximum 2 problem. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
7	Videos on safety aspects of workers working at construction sites and safety aspects of equipment used for high rise building construction and concreting.	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
8	Discussion on research papers related to civil structures, BIM and facilities etc.	4 hours per research paper. Maximum 15 h	Summarize research paper and evaluation critical parameters
9.	Poster/chart/power point presentation on topics such as Rain water harvesting, fire fighting systems etc. in high rise buildings, sustainable structures, earthquake resistant buildings etc.	Duration = 6 h	Based on poster/chart preparation and presentation skills
10	Working/non-working model on technical topics related to building construction and civil engineering structures	Working = 10 h Non- working = 8 h	Based on inter department/external evaluation
11.	Group Discussion on emerging/trending technical topics related to civil engineering structures, different types of concretes and buildings	Duration = 02 h each	Based on performance in group discussion, technical depth, knowledge etc.
12.	Real world case studies-based learning for state-of-the-art/new technology in building construction	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
13.	Use of Professional software for structural analysis, Building information management, Concrete mix designs etc.	Duration = 10 h	Depending on the complexity of the Application/Software
14.	Studies/surveys on requirements	Duration = 10 h	Based on in-depth study, data

	related to services in building like water supply, drainage, solar power and other facilities		collected, fact finding and suggestions etc.
15.	Workshop/seminar attended related to civil engineering	Duration = 4 hrs per Workshop and 2 hrs per seminar attended. Maximum 10 hrs	Based on report submitted of summary and outcome of workshop/seminar attended

Note:

- All the suggested activity should be related to the subject.
- The number of hours are suggestive. Faculty can sub-divide the number of hours based on the activity. However, total number of hours is fixed.
- For a course, minimum 3 to 4 activities shall be conducted. There is no limit for maximum number of activities; however any activity shall not be more than 10 hrs.
- Rubrics for the evaluation can be prepared by the faculty.
- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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