GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Civil (Structural Engineering)

Course/Subject Code:ME01000111

Course/Subject: Advanced Concrete Technology

w.e.f. Academic Year:	2024-25
Semester:	1st Semester
Category of the Course:	PEC

Prerequisite:	Concrete Technology, 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 behavior of concrete is very important for civil engineering students to become efficient civil engineering professionals. The course on Advanced 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.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Demonstrate cement hydration and its microstructure development.
02	Understand the concepts of special concrete.
03	Apply the concepts of Mix design to produce the concrete of adequate strength and durability,
04	Infer the results of the various experiments related to different ingredients of concrete, fresh concrete & hardened concrete.

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/ CA (M)	PA/CA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

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Course Content:

Unit No.	Content	No. of Hours	%of Weightage
1.	Sustainable Development concept, Introduction of Recent advances in Concrete Technology, Sustainable Construction Practices: world scenario	5	10
2.	Supplementing Cement Materials (SCMs): Review of types covering pulverized fuel ash, ground granulated blast furnaces slag and silica fume, Rice husk Ash, manufacture, physical characteristics, effects on properties of concretes. Admixtures: - Plasticizers, Super plasticizers, retarder, accelerators, Curing compounds and their effects on properties of concrete. Epoxy resins and screeds for rehabilitation – Properties and Applications	8	20
3.	Special Concretes: - High performance concrete, High Strength concrete, fiber reinforced concrete, Light weight concrete, High density and radiation shielding concrete, High volume fly ash concrete, Self compacting concrete, Green Concrete, Geo Polymer Concrete, Reactor Powder Concrete, Recycled concrete, Mass concrete, Sprayed concrete, Ferro-cement concrete, pumped concrete, Roller compacted concrete.	12	30
4.	Advanced Mixture Design, Design Philosophy - Particle Packing & Rheology - Discrete and Continuous approach, Packing density of powders and aggregates - Experimental tests and Models, Ternary Packing Diagram, Mixture Design of Self - Compacting Concrete (SCC); pervious concrete, Aerated concrete, Ultra high performance concrete (UHPC), Fibre reinforced concrete (FRC),	12	30
5.	Fresh Concrete Properties, Empirical test for SCC – Rheology, Basics, Parameters, Models, Rheometers, Rheology of Paste and concrete – Pumping, Setting, Curing, Plastic shrinkage, Strength Development, Maturity Method; Hardened Concrete Properties, Factors influencing strength, Interfacial Transition Zone, Stress strain relationship – Localization, End effects, Loading Conditions; Dimensional Stability, Creep and Shrinkage, Durability, Permeability and Porosity.	8	10
	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**
20	20	20	20	10	10

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(asper Revised

Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Neville, A.M., 'Properties of concrete', 4th ed., Pearson Education Limited, London,2000.
2. P. Kumar Metha and P. J. M. Monterio, Concrete- Microstructures, Properties and Materials, Indian Edition, Indian Concrete Institute, Chennai,1999.
3. Lea, F.M., Chemistry of cement and concrete, 3rd ed, Edward Arnold, London,1970.
4. De Larrard, F, Concrete Mixture proportioning, A scientific Approach, E&FN Spon, London,1999.
5. Aitcin, P. C., High Performance Concrete, E&FN Spon, London,1998.
6. Santhakumar, A. R., Concrete Technology, Oxford University Press, New Delhi,2007.
7. Neville, A.M., and Brooks, J. J., Concrete Technology, Pearson Education Ltd.,2012.
8. Kalliopi K. Aligizaki., Pore Structure of Cement-Based Materials: Testing, Interpretationand Requirements, CRC Press, 2005.

(b)Open source software and website:

1. http://nptel.ac.in/

Suggested Course Practical List:

1. Marsh Cone Test
2. Workability Tests on SSC like Slump Flow Test, L-Box Test, U-Box Test, V-Funnel Test, J-Ring Test.
3. Hardened properties of UHPC like Compressive Strength, Flexural Strength, Modulus of Elasticity.
4. Rapid Chloride Penetration Test.
5. Sorptivity Test.

Suggested Activities for Students: Students are supposed to do minimum two (2) concrete mix design in the remaining turns of laboratory as term work problems.

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