GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Construction Engineering & Management

Course / Subject Code: ME01014041

Course / Subject Name : Advanced Construction Material

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

Prerequisite:	Fundamentals of Construction Material
Rationale:	The study of Advanced Construction Materials is essential for advancing the construction industry, as it explores innovative materials that improve structural performance, sustainability, and efficiency. Mastery of these materials enables professionals to meet modern demands for durability, environmental impact reduction, and cost-effectiveness in construction projects.

No	Program Outcomes
01	Engage in critical thinking and research to develop solutions to multifold real-world problems.
02	Communicate effectively with the engineering community at large level on complex design tasks & prepare best workouts and deliverables.
03	Demonstrate a high level of professionalism in handling multidisciplinary and complex Construction engineering and management problems.
04	Plan, Schedule, Manage and Control the complex construction and infrastructure projects in a sustainable local and global context.
05	Address technical, societal issues pertaining to Construction engineering & management by offering state of art and robust, sustainable and practical solutions while upholding high standards of ethics and professionalism.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
1.	State and discuss the significance of construction material, its sustainability and achievable features for the prevailing as well as advanced construction.	U, R
2.	Discuss and categorize the applicability of advanced and state of art materials like virgin and recycled material.	U,N
3.	Explain and analyze the sustainability of advanced material	U,N

4.	Evaluate the viability of advanced construction material and measurable benefits .	N,E

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

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Construction Material** Classification, Specification, Properties, Durability, Deformational behavior, Details of microstructure of different construction materials, Different effects on materials of construction- Environmental Influences, Thermal effects of Chemicals, Fire resistance, Corrosion and Oxidation, Radiation. Tests as Per IS For Various Civil Engineering Materials, Issues with prevailing material and need for advanced material, Types & Differences between Smart and Intelligent Materials, Special features ,Case studies showing the applications of smart & Intelligent Materials.	13	30
2.	**Sustainable Material** Introduction, sustainability and goals, current situation, earth's natural system, carbon cycle, role of construction materials, CO2 from fossil fuel vis-à-vis cement and other construction materials. Construction material and indoor air quality. Energy for production, transportation and erection, Estimation methodology, Computation of embodied energy for building. Primary energy and Energy Concepts	8	20
3.	**Advance Concrete** Concretes, Behaviour of concretes ,Properties and advantages of High Strength and High-Performance Concrete, Properties and Applications of Fiber Reinforced Concrete & Self-compacting concrete, High volume fly ash concrete, Geo-polymer concrete Vs OPC concrete, use of Recycled aggregate,	12	25

	significance of quality control and admixtures in sustainability. Durability of construction material		
4.	**Other Materials** Thermo-Plastic, Composite, materials, Ferro cement, Ferro concrete, Building materials from Agricultural & Industrial wastes, Glass, Cladding, Types of plastics and properties , Polymer materials, Advantages of Reinforced polymers, Types of FRP, FRP on different structural elements, Applications of FRP. Types and properties of Water Proofing Compounds, Types of Non-weathering Materials and its uses ,Types of Flooring and Facade Materials and its application.	12	25
	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**
10	**40**	**10**	**30**	**10**	**--**

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

References/Suggested Learning Resources

Books:

1. Wu Chung, H (2006) Advanced Civil Infrastructure Materials, First Edition,Woodhead Publishing Limited.
2. Newman, J and Choo, Ban Sang (2003) Advanced Concrete Technology-Processes, 1st Edition, Elsevier
3. Aitkens , "High Performance Concrete", McGraw Hill, 1999
4. Mamlouk, M.S. and Zaniewski, J.P., "Materials for Civil and Construction Engineers", Prentice Hall Inc., 1999.
5. Shan Somayaji, "Civil Engineering Materials", Prentice Hall Inc., 2001
6. D.N. Ghose, "Materials of Construction", Tata Mc Graw Hill.
7. Jackson N. Ed., "Civil Engineering Materials", ELBS, London.
8. S.Z. Haider, "Material of Construction", Oxford Unviersity Press.

9. BRE Digest, “Building Materials”, the Construction Press, London.
10. CBRI, “Building Materials and Components”, Tata Mc Graw Hill.

Suggested Course Assignment /Tutorial List:

Practical Work Assignments Based on :

1. Gap analysis for the need of advanced construction material at various stages of construction based on multi criteria consideration.
2. Market study of conventional and advanced state-of-the-art materials.
3. Literature review of advanced construction where minimum 30 literatures are to be reviewed and minimum 50% literature should be of Indian context.
4. Preparation of Report on sustainability analysis of atleast five advanced /potential construction material.
5. Compatibility analysis of various advanced construction material with construction techniques
6. Benefit cost analysis of advanced /potential material.
7. Preparation of report on NBC Guidelines for building material.

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