GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Environmental Engineering

Course / Subject Code : DI03013011

Course / Subject Name : Construction Material and Technology

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

Prerequisite:	Knowledge of Building Drawing
Rationale:	This course is designed to make engineering students to Understand the properties, uses, and sustainability aspects of various construction materials, Learn about eco-friendly and innovative construction materials, Develop skills to test and assess construction materials in the lab, Lear about various building components and Emphasize sustainable practices in construction technology.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Identify and classify various construction materials based on properties and usage.	R & U
02	Select appropriate locally available masonry and binding material as per the requirement.	R, U & A
03	Understand and evaluate eco-friendly and sustainable construction materials.	R, U & A
04	Select the appropriate type(s) of foundation required for structure as per site/ soil condition.	R, U & A
05	Demonstrate awareness of sustainable construction technologies and green building concepts.	R, U & A

**Revised Bloom's Taxonomy (RBT)*

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.	**Introduction to Construction Materials** 1.1 Classification and properties of construction materials 1.2 Selection criteria for materials: strength, durability, economy, and sustainability 1.3 IS codes and standards for construction materials 1.4 Environmental concerns in construction material use	7	10
2.	**Masonry and Binding Materials** 2.1 Brick types, manufacturing, properties, and tests 2.2 Stones: classification, quarrying, and uses in construction 2.3 Alternative masonry materials: fly ash bricks, AAC blocks, hollow blocks 2.4 Environmental comparison of traditional vs. eco-friendly masonry materials 2.5 Types and grades of cement, hydration, setting time 2.6 Ingredients and proportions of concrete, mix design basics 2.7 Workability, curing, and strength of concrete 2.8 Chemical and mineral admixtures (plasticizers, retarders, fly ash, slag)	11	30
3.	**Timber, Steel, and Alternative Materials** 3.1 Timber: types, defects, seasoning, preservation 3.2 Structural and reinforcement steel: types, corrosion and preventive measures like painting, galvanizing, epoxy coating, cathodic protection 3.3 Use of bamboo, Plastic bricks, tiles, blocks made from recycled plastic, recycled materials in construction 3.4 Emerging materials: geopolymer cement, fiber-reinforced concrete	8	15
4.	**Sub structure and Building Items** 4.1 Definition and purpose of foundation	11	30

	4.2 Types of Shallow Foundations 4.3 Types of Deep Foundations 4.4 Timbering in trenches 4.5 Failures in foundation, Precautions & remedial measures. 4.6 Plastering & pointing- its purpose 4.7 Anti-termite measures and treatments and Damp proof course (DPC), water proofing 4.8 Types of staircase, Doors and Windows		
5.	**Sustainable Construction Practices and Technologies** 5.1 Green buildings: concepts, benefits, rating systems (LEED, GRIHA) 5.2 Smart and energy-efficient materials 5.3 Rainwater harvesting structures, permeable pavements, and eco-concrete 5.4 Low-cost and eco-friendly construction techniques	8	15
	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**
30	**50**	**20**	-	-	-

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

References/Suggested Learning Resources:
(a) Books:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Civil Engineering Construction Materials	S.K Sharma	Khanna Publishing House, New Delhi.
2	Building Materials	P.C Varghese	PHI learning, New Delhi.
3	Building Materials	S.K Duggal	New International, New Delhi.
4	Engineering Materials	Dr. Janardan Jha	Publisher. Khanna Publishers, Delhi

5	Building Construction	S. P. Arora and Bindra	Dhanpat Rai Publication, Delhi Edition 2013.1SBN: 9788189928803
6	Building Construction	S. C. Rangawala	Charotar Publication, Dist-Anand (ISBN-13: 978-8185594859)
7	Building Construction	B. C. Punrnia and AK, Jain	Firewall Media, 2005 (ISBN 9788170080534)
8	PWD Handbooks for Materials, Masonry. Building, Plastering and Pointing-Foundation	All India Council for Technical Education	All India Council for Technical Education (AICTE)
9	Practical Civil Engineering Handbook	Khanna	Khanna Publication
10	Energy conservation and green building	Vaibhao K. Sonarkar	Nirali Prakashan ISBN-13 : 9389108316-978
11	National Building Code	BIS	Bureau of Indian Standard, New Delhi

(b) Open source software and website:

a) www.nptel.iitm.ac.in
b) http://www.learningconstruction.comi
c) http://www.understandconstruction.corni
d) http://www.constructionknowledge.netiwww.learn-to–draw.com
e) https://www.khanacademy.org/
f) www.igbc.in
g) www.grihaindia.org

Suggested Course Practical List: If any

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Conduct local market survey for common civil engineering materials to tabulate cost and quality.	I	Home* assignment

2	Perform tests on given sample of brick such as Soundness, Water absorption, Compressive strength	II	6
3	Conduct field test on given sample of brick and cement.	II	2
4	Perform lab tests on given sample of cement such as Initial and final setting time, Compressive strength, tensile strength of steel	II	4
5	Perform test on given sample of fine aggregate such as Sieve analysis, Silt and clay content.	II	2
6	Assess the quality of different types of timber and timber products (please arrange to visit nearby saw mill or timber mart).	III	2
7	Prepare a report on use of Bamboo in construction,/ Plastic and Waste-Based Materials/Composite Materials/Geopolymer Cement and Concrete/Earth-based Materials	III	2
8	Identify components of building and /structures in the given model/sketches	IV	2
9	Draw foundation plan and mark layout on the ground for a building of Two room load bearing structure from the given line out plan.	IV	2
10	Draw sketches for Foundations-Various types and timbering in Trenches in sketch book.	IV	4
11	Prepare a visit report to the construction site where activities such as Flooring, Plastering/ Pointing and Painting are being executed considering standard safety procedure.	IV	4
12	Prepare a visit report to the construction site where activities such as Excavation, Foundation, Masonry, Scaffolding, Formwork, Centering and Concreting are being executed considering standard safety procedure.	I to V	4
13	Draw sketches for various types of Doors, Windows and staircases	IV	2
14	Presentation on Sustainable construction practices/model of Green Building	V	2
		Total	30

List of Laboratory/Learning Resources Required:

Compression Testing Machine, Sieves (IS Sieve Set), Tensile Testing Machine or UTM, Models or Cut-Sections of Materials, Multimedia Resources / Smart Board etc.

Suggested Project List:

a) **Green Building material:**.Prepare Low-Cost Brick Using Waste Materials, Preparation of Bamboo Reinforced Panels, Model of a Green Building Section
b) **Foundation:** Construct a model foundation using recycled or sustainable materials
c) **Construction Technology:** Demonstrate the structural potential of bottle bricks
d) **Maintenance:** Create a poster/display board cataloging natural material defects/Prepare a report on remedial measures that can be taken to repair the cracks in the nearby building.
e) **Miscellaneous material:** Carry out market survey for identifying various waterproofing materials and prepare a report including application procedure.
f) **Safety:** Prepare posters/ charts for the awareness of safety in various activates of civil engineering construction.

Suggested Activities for Students:

a) Create visual charts on "Types of Cement," "Defects in Timber," "Eco-friendly Materials," etc.
b) Create small models of foundation types, wall sections, etc., using real or craft materials
c) Students collect or present samples of alternative, recycled, or local eco-friendly materials

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