B. Tech. Civil Engineering				
Course code: Course Title	**Course Structure.**			**Pre-Requisite**
CE416: Masonry, Timber, and Bamboo Structures	L	T	P	Nil
	3	0	2	

Course Objective: This course aims to provide students with an understanding of the properties, behaviour, and design principles of masonry, timber, and bamboo structures, focusing on their resistance to earthquake, wind, and cyclone forces. Students will learn to design and evaluate these structures under various loads, understand failure mechanisms, and apply relevant codes (IS 1905, IS 4326, IS 15912). The course also covers emerging trends in sustainable construction and heritage preservation.

S. No	Course Outcomes (CO)
CO1	Understand the engineering properties of masonry, timber, and bamboo materials.
CO2	Analyse the structural behaviour of masonry, timber, and bamboo under various loads.
CO3	Apply earthquake, wind, and cyclone-resistant design principles to these structures.
CO4	Design masonry, timber, and bamboo structures considering axial, flexural, and shear loads.
CO5	Explore emerging trends in construction, preservation of heritage structures, and sustainable innovations.

S. No	Contents	Contact Hours
UNIT 1	**Engineering Properties of Materials**: Engineering properties of masonry, timber, and bamboo; Types of masonry: Brick, stone, concrete blocks, reinforced masonry; Types of timber: Solid wood, engineered wood, laminated wood products; Types of bamboo used in construction; Durability, fire resistance, pest resistance, and preservative treatments.	8
UNIT 2	**Structural Behaviour Under Various Loads**: Principles of earthquake, wind, and cyclone-resistant design; Structural behaviour of masonry, timber, and bamboo under gravity, seismic, wind, and extreme weather conditions; Failure mechanisms and response to axial, flexural, shear, and torsional loads; Strengthening techniques; Stability criteria; Relevant codes (IS 4326 for masonry, IS 15912 for bamboo, and timber codes).	8
UNIT 3	**Design of Masonry Structures**; Structural Limit state design of masonry walls, arches, bridge substructures, and retaining walls for Gravity, seismic, wind, and cyclone loads; Relevant codes: IS 1905, Eurocode 6, ACI 530, IS 4326 (for seismic design).	10
UNIT 4	**Design of Timber and Bamboo Structures**: Structural limit state design of timber and bamboo beams, columns, and trusses for axial, flexural, shear, and torsional loads; Design of joints and fasteners: Bolted, nailed, glued, and dowel connections; Relevant codes IS 15912 (for bamboo), ISO 22156 (for bamboo), and timber codes.	8

UNIT 5	**Emerging Trends and Preservation of Archaeological Structures**: Seismic retrofitting techniques, Prefabrication and modular construction in masonry, timber, and bamboo; Smart materials and composites; Sustainable innovations in heritage preservation; Case studies of successful preservation and adaptive reuse of historical buildings; Challenges in maintaining structural integrity of ancient masonry and timber structures; Techniques for seismic retrofitting of heritage structures.	8
	TOTAL	**42**

References

S. No	Name of Books/Authors/Publishers	Year of Publication Reprint
1	M. D. Bondy, Design of Masonry Structures, McGraw-Hill, ISBN: 978-0070666667, 1st Edition.	2012
2	E. S. Hearn, Masonry Design and Construction, Routledge, ISBN: 978-0367338931, 1st Reprint.	2017
3	James R. McDonald, Structural Masonry: Design and Construction, Wiley, ISBN: 978-1118291567	2015
4	R. L. Taylor, Masonry Design and Construction, Longman Scientific and Technical, ISBN: 978-0582247369, 2nd Reprint.	1996
5	IS 1905: 2002, Code of Practice for Structural Use of Masonry, Bureau of Indian Standards (BIS).	2002
6	IS 4326: 2013, Code of Practice for Earthquake Resistant Design and Construction of Buildings, Bureau of Indian Standards (BIS).	2013
7	Eurocode 6: 2005, Design of Masonry Structures, European Committee for Standardization, ISBN: 978-1841193664.	2005
8	ACI 530: 2019, Building Code Requirements for Masonry Structures, American Concrete Institute (ACI), ISBN: 978-1942837657.	2019
9	A. S. Arya, Masonry and Timber Structures, Name Chand and Brothers, ISBN: 978-8185780092	2011, -
10	M. A. Green, Timber Design: Principles and Practice, Wiley-Blackwell, ISBN: 978-0470626366	2013, 1st Edition
11	B. J. Givoni, Design of Timber Structures, Elsevier, ISBN: 978-0444872076	1985, -
12	C. E. W. Lutterodt, Timber Engineering: A Design Guide, CRC Press, ISBN: 978-0367338092	2019, -
13	K. J. Williams, Structural Timber Design, John Wiley & Sons, ISBN: 978-0470663506	2010, 2nd Reprint
14	Johan V. L. Rook, Bamboo: Seismic and Wind Resistant Design for Sustainable Buildings, ISBN: 978-1138922325	2017, 2nd Reprint
15	Hannah C. Webb, Designing for Earthquakes and Cyclones with Bamboo, ISBN: 978-1138925692	2016, -

16	P. R. Bhandari and S. K. Gupta, Seismic Performance of Bamboo Structures: Challenges and Solutions, ISBN: 978-8184246250	2014, -
17	David Brown, Building with Bamboo for Extreme Weather: Cyclone and Earthquake Resilience, ISBN: 978-1138746709	2018, -
18	C. E. S. Thompson, Bamboo Structures and Earthquake Engineering, ISBN: 978-3319071174	2014, 1st Reprint
19	Ravi K. R. Sundar, Seismic Design of Bamboo Buildings: A Guide for Engineers and Architects, ISBN: 978-1138748611	2020, -
20	IS 15912: 2012, Code of Practice for Bamboo for Structural Use, Bureau of Indian Standards (BIS)	2012, 1st Reprint
21	ISO 22156: 2004, Bamboo Structures – Structural Design of Bamboo for Building and Construction, ISBN: 978-9284200962	2004, 1st Reprint
22	R. S. Dhawan & R. S. Sharma, Design of Bamboo Structures: Seismic and Cyclone Safety, ISBN: 978-8189766790	2013, -
23	B. G. L. Suresh, Bamboo in Construction: Seismic and Cyclone-Resistant Design, ISBN: 978-8126909391	2015, -
24	Duggal, V., Earthquake Resistant Design of Structures, Oxford Higher Education, ISBN: 978-0198069704	2007, 1st Edition